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CONTROL OF HABITS IN TREATMENT OF MALOCCLUSION

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HABIT, as an etiological factor of malocclusion, was given no consideration until early in the nineteenth century. The habit of "projecting the under jaw forward, and of shutting the under front teeth beyond the upper teeth" was described by John Fuller in 1810. "This," if not corrected, he thought, "could cause the upper teeth to grow within the lower teeth and result in a deformity of the mouth." Although the habit of thumb-sucking was mentioned and described by William Imrie in 1841, the first real emphasis to be placed upon it as a cause of malocclusion did not occur until T. H. Chandler in 1878 said, "There is no one cause so productive of malformation of the bones of the mouth and irregularity of the teeth as the habit of thumb-sucking in infancy, the different positions of the thumb giving rise to different kinds of deformity."

Kingsley was one of the first writers to mention mouth-breathing, but it was not until 1901 that Mayo Collier described quite accurately the facial picture of the mouth-breather with the characteristic type of malocclusion, and seemed definitely convinced in his own mind that mouth-breathing produced a definite type of malocclusion.

In 1914 Jessen spoke of habits being performed unconsciously by the child, and in the following year, 1915, A. LeRoy Johnson introduced the psychologic and biologic consideration of habits from the viewpoint of their origin and operation. This marked the beginning of the progress which has led to our present ideas of the correction of habits.

During this period, 1915-1938, Harvey Stallard called attention to the pillowing habit as a cause of malocclusion, and Samuel J. Lewis, by scientific investigation, gave definite clinical proof of the relation of various habits with various malocclusions.

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Within the last ten or fifteen years, much valuable psychologic material on the basic problems of child development has been added to the knowledge in this field. Some investigations resulted in the application of wrong conclusions, but these instances have led to more careful study resulting in more successful applications of more accurate conclusions. The influence of early habits on the adult has aroused interest in child development. The manner of formation of habit is much more apparent in the preschool child because he has fewer fixed reactions than the adult.

James says: "An acquired habit, from the physiological point of view, is nothing but a new pathway of discharge formed in the brain, by which certain incoming currents ever after tend to escape. . . . A simple habit, like every other nervous event—the habit of snuffling, for example, or of putting one's hands into one's pockets, or of biting one's nails—is, mechanically, nothing but a reflex discharge; and its anatomical substratum must be a path in the system. The most complex habits are, from the same point of view, nothing but concatenated discharges in the nerve centers, due to the presence there of systems of reflex paths, so organized as to wake each other up successively—the impression produced by one muscular contraction serving as a stimulus to provoke the next, until a final impression inhibits the process and closes the chain."

"Physical training begins at birth with the baby's motor responses to sensory stimuli, and the reflex habits thus initiated are the result of (1) hereditary or instinctive forces and (2) acquired responses to environmental, somatic and cerebral stimuli." (Loman.) These responses overlap and combine to form the intricate patterns of activity of life. When a child is learning an act, many things he does are already familiar. As new movements are added to his experience, he gradually modifies them until a final pattern has been established. This is called a "learned" response. Frequent repetitions of this response finally become practically automatic and the habit is formed. The longer a fixed habit exists, the more difficult it becomes to change.

Habit, because of its automatic characteristics, simplifies movements, makes them accurate, and diminishes fatigue. Exhaustion would follow the simplest act if conscious effort were necessary for every movement.

It is generally recognized that habit is an etiological factor of malocclusion, but habit may also be our greatest ally in the successful treatment of malocclusion. Orthodontists of experience recognize its significance and carefully investigate any possibility of an existing habit. Habit as related to orthodontics must be considered under two heads; namely, pernicious habits and functional habits. Pernicious habits as etiological factors of malocclusion may be either primary or secondary. In treatment it is essential that these habits be eliminated if the prognosis is to be favorable. Functional habits are those necessary to normal function, and unless these are balanced orthodontic treatment will fail. The functional habits are correct tongue function, proper respiration, deglutition, mastication, and normal use of the lips in speaking. "So orthodontics, too," says David W. McLean, "is advancing from esthetics based upon gnathostatics to esthetics based on gnathodynamics; and is finding that, after all, the most beautiful biologic entities are those oriented and proportioned to fully perform their functions."

Acts are performed correctly or incorrectly as they have been learned. The importance of correct education is apparent. Re-education becomes difficult, and its success is dependent upon the ability of the orthodontist to influence the patient, of any age or comprehension, to voluntary cooperation.

Motivation is the aroused interest or intention of the child to perform an act, to reach a goal, or to break or form a habit. This problem is closely related to the personalities of the child and the orthodontist and requires ingenuity, wisdom, personality, sympathy, and understanding. A favorable atmosphere for learning must be created to stimulate the child to learn. The will to learn is influenced by pleasant situations, the avoidance of unpleasant situations, and the desire for attention from others. Experimental studies have shown that consequences should be directly associated with the act. This is essential in either punishment or reward, to gain new responses or to break down old responses. A reward promised in the future has no value. Little children need immediate satisfactions. Care, however, must be exercised when offering a reward. The prize offered once may be the cause of lack of effort in the hope that more prizes may be forth coming. One of the best rewards is praise for something well done, and the best incentive to effort lies in the joy of accomplishment.

General observation has shown that threatening is worthless. The child soon learns that threats are not carried out and that it is safe to pay no attention. Scolding may degenerate into nagging, and the harmful result of threatening and nagging is the formation of avoidance habits.

Building up an antagonistic response is oftentimes useful in breaking a habit. Some other activity is substituted for the habitual activity. Because children are so impressionable the power of suggestion is great and they will readily change from one activity to another. Occasionally the opposite is true and in that event it is necessary to apply a negative suggestion. In this case the child must be told to do the thing one does not desire him to do. Care should be taken to avoid undue excitement or irritability, since the breaking of a habit usually involves some emotional stress.

When giving verbal instructions it requires skill to make the child understand and wisdom to understand his replies. Because of lack of knowledge of many words the child relies a great deal on facial expression, gestures and actions of the adult. A child will learn to react to the frown of a parent as a sign of disapproval preceding punishment long before he understands the words associated with the act. It is not necessary to alter speech, actions or attitudes when conversing with a child any more than when talking to an adult. Too many associations or too much irrelevant talking detracts from the instructions and is a fault to be avoided.

The problem of instructions is always difficult. Many times the child fails to grasp the instructions because of visual deficiency. Performance of the act may be hampered because the patient did not see a clear image in the mirror. All instructions should be demonstrated as well as given verbally. Instructions are only partially understood in cases where hearing is deficient. These deficiencies make it difficult for the child and add a fatiguing stress which is burdensome. When defects of the sensory mechanism are present, information necessary to influence the motor acts required in our therapy, is lacking. All of you

have asked a patient to "close" and found that the incisors were placed end to end. The difficulty experienced by some patients in placing the mandible in its functional relation when asked to do so is evidence of the lack of coordination in performing this motor act. All the senses combine to aid in the control of the body or individual parts of the body. The execution of a golf swing to be successful requires coordination made possible by the senses and repeated trials until the swing becomes a habit.

The habit of lip-biting is quite common and is probably encountered more than any other. It exists in many forms and in combinations with other habits. It may be the primary etiologic factor of a malocclusion or it may be a secondary factor associated with and complicating a malocclusion caused by other etiologic factors. In other cases it exists because of the malocclusion itself. Fig. 1 shows three malocclusions in which different types of lip habits are involved. In the first case the patient bites the left side of the upper lip; in the second case the

Fig. 1.—Three malocclusions associated with lip-biting. In the first case the left side of the upper lip was bitten; in the second case the lower lip; and in the third case the left and right sides of the lower lip were bitten alternately.

patient bites the lower lip; in the third case the patient bites the lower lip first on one side and then on the other, causing the rotation of the maxillary central incisors. The commonest form of lip-biting follows a definite sequence. The beginning of the act is the wetting of the lip or lips with the tongue. The lower lip is turned inward and the tongue then returns to the mouth. As the tip of the tongue passes the incisal edges of the maxillary incisors, the lower lip is caught between the maxillary and mandibular teeth and pressure is exerted as the lip slowly returns to its original position. The force produced by the lip as it slides over the teeth moves the maxillary incisors labially and the mandibular incisors lingually. The deformity reaches its maximum when the discrepancy between the maxillary and mandibular incisors becomes equal to the thickness of the lower lip. The malocclusion is then retained by the lower lip. The characteristic facial expression of the lip-biter (Fig. 2) shows the lower lip fitting under and in contact with the maxillary incisors when the mouth is closed. Often the upper

lip may be fairly well developed, as seems to be the case in this instance. When this occurs the protrusion is limited by the balancing pressure of the upper lip. The variations of this habit are many. The act may be done slowly and again it may be done so rapidly that it is almost impossible to detect. In other cases the lip may be held quietly between the teeth with varying amounts of pressure. Only one side may be bitten and in other cases it may be bitten alternately from side to side. In others the whole length of the lip may be dragged through a space between the central incisors. In some cases only the upper or the lower lip is bitten, while in others both lips may be involved. As you observe the motion pictures of the three lip-biters please note the variation in the performance of the habit.

Lip-biting may be associated with other habits such as tongue thrusting and abnormal swallowing. As you observe the motion pictures of a girl having this

Fig. 2.—The facial characteristics of the typical lip-biter (after McCoy).

particular association of habits which have been etiologic factors in a malocclusion which is quite severe, please note that the tongue is thrust forward as the lip is moistened. This is then followed by an extreme upward and outward pressure of the lower lip against the lingual surfaces of the maxillary incisors as the first stage of the swallowing act occurs. The continued repetition of this act has caused an extreme overdevelopment of the mentalis muscle.

Treatment of the lip-biting habit requires the utmost cooperation of the patient. Seldom is the patient or parent aware of this habit until attention is called to it. To break the habit successfully it is essential that the patient have the will to break it. Most patients will promise to break the habit, but this is soon forgotten unless the desire is really present in the mind. The harmful effects of continuation of the habit must be explained and demonstrated. As a method of demonstration which may be used in selected cases to impress upon the patient the difference in the appearance a continuation of lip-biting may produce, the orthodontist may place over his own teeth a denture with the teeth set

up similar to a malocclusion caused by lip-biting. If this demonstration is done seriously and without an attempt to entertain and is followed with a remark such as "you don't want to look like that," the motivation may be supplied to produce the desire really to break the habit. The services of the orthodontist then may be offered by suggesting an aid to help make it possible for the patient to break the habit. The responsibility is still left entirely to the patient.

The motivation which will produce the "will to do" varies with each personality, and to discover in that personality that which furnishes the motivation depends upon the ability of the operator. This motivation may be an appeal to the sense of pride, fear, punishment, reward, or cooperative helpfulness. The fact that the habit is done unconsciously means that some definite aid to the patient must be furnished until the activating response has been eliminated. Correction of the malocclusion is of paramount importance, and in extreme cases no habit therapy should be applied until the protrusion is reduced to the extent that the lips may be closed without extreme effort. It has been suggested that

Fig. 3. Fig. 4.

Fig. 3.—The position of the tip of the tongue in open-bite malocclusion when swallowing.
Fig. 4.—Note the expression of the lips when closed with the tongue held in the opening between the teeth.

the urge which activates the response may be the teeth which rest on the lip. The chapped condition of the lip due to continual wetting may also supply the urge. A pomade lipstick may be used as an aid to the patient. This not only relieves the chapped condition which may help to remove the activation, but it also serves as a reminder not to bite the lip when the tongue feels the grease on the lip as the act begins. In some instances a mechanical aid, which consists of attachment bands on the maxillary incisors with sharp spurs soldered on the lingual to prick the lip, may be used. This method, however, is indicated only after all other efforts have failed.

Tongue habits are perhaps the most stubborn and difficult to correct. The malocclusions caused by these habits are usually severe. Many of the open-bite cases which are so difficult to treat are the result of a tongue habit; and unless the habit is really corrected and normal tongue function is restored, the treated case is sure to relapse. A tongue habit may affect any part of or all the arch. In some instances it is confined to the posterior segments either unilaterally or bi-

laterally, and in others it exists only in the anterior portion. The habit usually consists of a thrusting of the tongue although there may be many variations. During the first stage of the act of swallowing it is usually forced forward between the teeth with much force (Fig. 3). The tongue may simply be held passively between the teeth. Fig. 4 shows the peculiar expression of the lips when the tongue is held passively between the teeth.

Fig. 5 is of a boy whose malocclusion is the result of a tongue habit. The moving picture of this boy portrays his nervous temperament as well as the tongue habit. His malocclusion is a severe open-bite with only the molars in occlusion (Fig. 5).

Theoretically, if the tongue ceases to be placed between the teeth, the incisors should continue to erupt until they are in occlusion. Because this child showed a cooperative spirit the treatment of his case was based on this theory. The

Fig. 5.

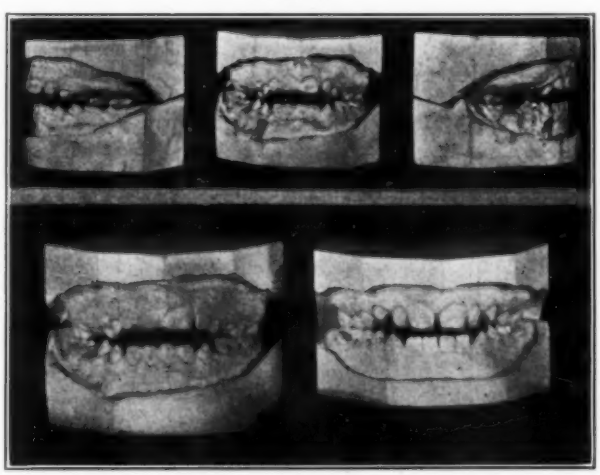

Fig. 6.

Fig. 5.—An open-bite malocclusion with a tongue habit as an etiological factor.

Fig. 6.—Note how much the open-bite has closed after the patient practiced tongue exercise for eighteen months.

maxillary arch was a trifle narrower than the mandibular, so a lingual arch was inserted for the purpose of expansion. An exercise to teach normal tongue position and normal swallowing was given, and Fig. 6 shows that after eighteen months the bit has closed approximately two thirds.

In most of these open-bite cases the incorrect use of the tongue in pronunciation of certain sounds, such as "th," is a contributing etiological factor and unless corrected offers resistance in retention.

One of the best methods of teaching normal tongue function is one devised by Lloyd S. Lourie. A small piece of candy, about one-fourth or one-third of a life-saver in size, is placed upon the palate just posterior to the maxillary incisors where it is held by the tip of the tongue. This position is carefully taught to the patient, and when each act of swallowing occurs the tip of the tongue is held in correct position. There is, however, one important point which must be observed. If the piece of candy is held farther back on the

palate than just behind the incisors, it will be held there by the dorsum of the tongue, and the tip of the tongue will be free, as always, to fill the space between the teeth, and the purpose of the exercise is defeated. During meals the patient should be urged to swallow with the tongue in the correct position. The exercises for the tongue and for teaching normal deglutition as described by Robert W. Strang on page 599 of his text, *A Text-Book of Orthodontia,* are recommended. Correction of the misuse of the tongue in speech is indicated. Occasionally, mechanical appliances may be of aid in keeping the tongue away from the open portion of the occlusion. Spurs on an appliance to prick the tongue may be used. A better method than spurs is the appliance as described by George M. Anderson in an article "Mandibular Retainers With Incisor Springs and an Appliance Designed to Assist Breaking Tongue Habits." He says, "A small removable plate, Hawley type, is used with a fence of round wire, usually 0.036, extending from the palatal vulcanite to the lingual gingival margin of the mandibular incisors and against their lingual surfaces. Since it is removable, it does not interfere with eating, is not uncomfortable, and seems

Fig. 7.—Early thumb-sucking in infant four weeks of age.

to have no effect on speech." This appliance is not necessarily limited to the cases in which the open-bite occurs in the incisor region but may be applied when the opening occurs in the bicuspid or molar regions.

The sucking movement is one of the first forms of specific behavior which appears in the infant. This is a complex reaction and does not always occur when the lips alone are stimulated. Other muscle groups, as the cheek, tongue and those that control lip movements, are coordinated in sucking, and the stimulation of any one muscle group may result in sucking movements. Other types of stimuli which may stimulate sucking are odors, tastes, and varying temperatures. After the first week, however, the sucking reaction becomes more specific and occurs primarily in response to lip or tongue stimulation.

One variety of the sucking habit is lip sucking. Either lip may be sucked and in many cases may be accompanied by almost any variation. Extreme pressures are in force in the lip sucking habit. In the moving picture of a girl who sucks her upper lip please notice how the lip is alternately blanched and flushed as the blood is forced in and out of the lip as pressure is applied and relieved.

The second lip sucking habit shown is that of a boy whose sucking habit is combined with peculiar manipulations of the lips and tongue. The motion picture must serve as a description of his habit. Needless to say this boy has a malocclusion which is indeed severe.

The treatment of lip sucking depends upon the individual habit and its variations. In general, the principles used in treatment of lip-biting and tongue habits may apply (especially the sharp-spur-bearing appliance).

The commonest form of sucking habit is thumb- and finger-sucking (Fig. 7). The etiology, perhaps, is important from the standpoint of treatment, but there seems to be very little agreement on this subject. David M. Levy states that the cause of thumb- or finger-sucking is insufficient sucking at the breast or bottle. The babies who had to work a comparatively long time for their food did not suck the thumb. Those who used pacifiers did not suck the thumb. He further states: "Rationally, according to the studies described, the prophylactic and also the direct therapeutic device in infancy consists in a return to the use of the pacifier. The arguments based against its use are based either on inference about the pacifier as a source of infection, which has not been proved, or on certain abuses of it, which are no longer necessary." It seems obvious that there would be no necessity for an infant to suck its thumb if a pacifier would do as well. To return to the use of the pacifier as a therapeutic measure certainly is not warranted.

Periods, such as teething periods, which stimulate placing the thumb or fingers in the mouth suggest sucking and set up a definite cycle which includes the stimulation and the repetition of the act itself. No alarm should be felt when an infant puts the thumb or finger in the mouth unless the act is repeated too frequently. As an infant performs the movements of the arms during the course of general activity, the hand may come into contact with the cheeks or lips and may furnish a stimulation for sucking. This may be the beginning of a thumb-sucking habit.

Sucking the thumb, in many instances, is accompanied by some practice which causes pain as pulling the hair or scratching the body. These are called accessory movements and may become a part of the pattern of the sucking act. These movements are not limited to the thumb-sucking habit but may be present in normal sucking of the breast or bottle. When an accessory movement is initiated sucking may be stimulated.

Buford Johnson says: "Thumb-sucking as a problem in the child of from one to five years of age probably has its basis in the failure of the diffuse activities of the infant to become differentiated into specific behavior toward an end. The relation to hunger is important. Since sucking movements are so frequent in early behavior and are associated with food-getting and with the preceding hunger reactions, the habit may easily be formed if periods of hunger are prolonged. A careful regime of feeding adapted to the child's activities does not alone prevent too frequent sucking of the fingers. The ends of activity for the infant appear to be other activities. When stimulation and opportunity for progressor movements and for manipulation are provided, the infant is less likely to suck the thumbs. Hard surfaces that offer resistance

stimulate toward pushing, rolling, kicking and pulling. Objects that are stable and hold fast under the forceful attacks of the infant but which stimulate the child to climb, maintain equilibrium, and experiment with movements provide for wholesome activities. The increased activity due to hunger may even be utilized in this way. When the infant is hampered by clothing, is placed upon soft beds and pillows during activity periods, or is provided dainty but wobbly pens, the gross muscle activities are curtailed. Compensation is often found in the easy accessible finger.''

Fig. 8.

Fig. 9.

Fig. 8.—A girl who sucked her thumb until three years of age. No doubt normal lip function was absent in this instance.

Fig. 9.—The occlusion of the patient shown in Fig. 8.

Many misleading articles and statements have been written in regard to the unharmful effects of thumb-sucking. These conclusions have been based on studies which go only halfway. It is unfortunate when these statements are made available to the general public, for it sets up a false security among parents, which is responsible for the innocent neglect of these habits. The statement, which unfortunately has been made by some orthodontists, that if the habit of thumb-sucking is broken by three and one-half to four years of

age no effect will be shown in the permanent dentition, is very misleading. This is true only in those cases in which normal lip function acts as an appliance and corrects the malocclusion, and this can happen only in cases in which the pressure on the incisors when sucking the thumb has been in an upward and outward direction and the malocclusion is a Class I Angle malocclusion. If this normal lip function does not exist after the habit is broken, the malocclusion will in all probability continue with increasing severity. Fig. 8 shows a girl who sucked her thumb until three years of age. No doubt normal lip function was absent in this instance.

Fig. 9 shows her occlusion. In cases in which the back of the thumb acts as the fulcrum for the forward and upward prying of the thumb on the palate, alveolar process, and the maxillary incisors and because of this prying the mandible has been forced into a distal relation to the superior maxilla the malocclusion probably will not correct itself and will be present in the permanent dentition. The motion picture shows a thumb-sucking habit in which the hand is held so that the pressure is exerted in an upward and outward manner and the malocclusion is a neutroclusion.

The treatment of thumb-sucking is sometimes a tremendous task; one method after another will have to be tried until the right one is reached. When the correct method is found, however, the habit is usually broken in a few weeks. There are numerous methods of treatment described in the literature, and these are mostly case reports. No investigation of any one appliance on a number of cases has been done. We have no scientific evidence of the value of methods of treatment of this habit. Psychiatrists are puzzled as is every one else. All that can be done at present is to familiarize oneself with the different methods and attempt to apply them correctly. It is generally conceded that the best method of treating the habit is to prevent it.

In very young children elbow cuffs, splints, aluminum mitts, wire frames for the thumb, pinning the night clothes, etc., may be used. In older patients the deciduous first molars may be banded and a bar constructed to extend across the palate. The bar may or may not carry sharp spurs and should be so constructed as to stand far enough away from the palate to destroy any possibility of suction between the thumb and the palate. This may correct a pleasure-giving situation into an unpleasant one and thus effect a cure. Bitter aloes, quinine, etc., may be painted on the thumb, but its efficiency as a cure is doubtful. The infant soon develops a tolerance which soon becomes a liking for the taste of the drug.

Another method successful in some cases is that of practicing the habit before a mirror. The child should be taken from his favorite play and, in a serious mood with the mother present, be placed in front of the mirror and told to suck the thumb as he watches the performance in the mirror. The theory is that when the habit becomes a conscious habit it automatically ceases. The length of each practice period should be governed by the age of the child. A child will learn more in longer practice periods if relatively long intervals are allowed to elapse between periods than in repeated trials at short intervals.

A method which has been successful in numerous cases is that of placing boxing gloves on the hands (Fig. 10). When laced upon the wrists it is diffi-

cult for the patient to get them off; they permit freedom of movement and present a thumb too large for the mouth. This method is best applied to those children who indulge the habit as an aid in inducing sleep.

Again Buford Johnson says: "It is very doubtful if mechanical appliances on fingers or splints to arms aid as much as they interfere in the elimination of the excessive thumb-sucking. They are likely to focus attention upon the arm or hand which is already associated with the response, thereby serving as a stimulus. Restriction may accentuate the desire by continued stimulation of arm and finger and by interference with other activities that might supersede the sucking reaction. The infant often sucks clothing or bed-covering as a substitute. In the beginning, the emotional elements appear to be minimal but after the first year the thumb-sucking readily becomes a substitute activity under situations that arouse emotional excitation of a mild sort. With proper

Fig. 10.—Boxing gloves are an excellent cure for thumb-sucking.

nutrition and desirable environmental conditions for gross muscle coordinations, it is doubtful whether excessive thumb-sucking would occur. When it has developed beyond the expected frequency, less attention to the reaction itself and more attention to provision of stimulation toward desirable activities would appear to be the better method of treatment." Events during the first year, which embrace marked emotional elements, influence behavior which closely follows the event and will develop habits of response which may make for either maladjustment or efficiency.

Mouth-breathing and the open mouth habit are conditions frequently encountered. These two habits are separate though sometimes associated. One may have the open-mouth habit and still not be a mouth-breather. It is important to check the respiration to make sure with which habit one is dealing. The accompanying malocclusion may be of any type. If the case presents a protrusion which is severe enough to make the closing of the lips a great effort,

treatment of the habit should be postponed until the appliances have reduced the protrusion at least partly if not entirely. Most of these patients use the lower lip almost entirely in closing the lips, and this causes an overdevelopment of the mentalis muscle (Fig. 11). Overdevelopment of the mentalis muscle is recognized by the dimpling of the chin caused by the contraction of muscle fibers which insert directly into the skin.

This is a complication which must be eliminated in the successful treatment of mouth-breathing. Other factors, such as correct use of the tongue in swallowing, must be carefully observed. To develop the upper lip the action of the mentalis muscle must be limited. This is done by grasping the chin between the thumb and first finger and the lower lip is held tightly. The attempt then to close the lips forces the upper lip to come down to meet the lower. This exercise is done for several minutes several times daily. When it

Fig. 11.—Note the dimpling of the chin because of the overdeveloped mentalis muscle.

is possible to close the lips correctly, the mouth-breathing or open-mouth habit may be corrected. Cooperation of the patient is important. A celluloid paddle may be held lightly between the lips when the child is studying or reading or a glass of water may be kept at hand and a sip of water held within the mouth. If the lips open the water will spill or the paddle will fall as the case may be. The "will to do" must be present and these methods act only as aids to the patient. If the habit is mouth-breathing, breathing exercises are necessary. A very valuable exercise to give at this time is that of whistling. The muscular action in whistling is a combination of all these exercises. It will develop the orbicularis oris and associated muscles; it develops the downward thrust of the mentalis; and it develops the muscle nasalis whose action is directly proportionate to the activity of the orbicularis oris. The higher the note whistled the more activity occurs in the orbicularis oris and nasalis muscles. It is surprising to note that few children with extreme protrusion of the maxillary incisors have ever learned to whistle.

The propping habits are usually well taken care of in school when the children are taught correct posture. At home the child must not be permitted to lie on the floor when reading if the elbow and hands are used to hold the head.

Dr. Harvey Stollard says, "A child may, by a pillow habit, imprint his shoulder, arm, forearm, wrist, fist, flat hand, or metacarpals into either the maxillary or mandibular arch or into both simultaneously, causing 'saddle-shaped maxillary arches' and similar contractions in the mandibular arch." Herbert R. Foster in an article entitled "How to Practice Dentistry for Children as Preventive Orthodontia" suggests several methods of treatment, such as sleeping on a board which offers more comfort when one sleeps on the back than when on the abdomen; a harness made of discarded neckties which prevents a child from rolling over onto the stomach but otherwise permits freedom of movement; and the method of sewing two or three rows of golf balls or blocks vertically down the front of the child's sleepers. The method of using golf balls or blocks is the only method I recommend.

There is one other condition which must be mentioned and which might be classified as a habit and that is the "dual bite." By "dual bite" is meant an occlusion which may be used in two relations according to the particular function being used at a given moment. These occur in some cases of distoclusion although not necessarily treated cases. The patient closes the teeth in centric relation with the mandible in normal relation to the superior maxilla, but as soon as the function of speech, laughter or mastication begins, the mandible functions in distal relation to the superior maxilla. Rogers suggests that in many of these cases the muscles controlling the position of the mandible are relaxed much of the time, and in some cases he suggests the possibility of a propping habit as a contributing factor. Treatment of this condition consists of continuing the use of a bite plane, after cuspal interference has been removed, together with the exercise for the masseter-temporal group until function is well established. The bite plane must be worn when masticating food. It is wise, after the bite plane has been worn for a short time, to observe whether the mandibular incisors in function are occluding with the plane not posterior to it. While normal function in correct relation is being established, it is said that a change occurs in the neck of the condyle which permits the head of the condyle to rest in its normal position. When this has been accomplished it is impossible for the mandible to function in the distal relation.

The treatment of habits, from the standpoint of either correction or formation, generally is an individual problem. The factor of individual differences is an extremely important consideration. Differences in children are noticeable within the first year. One may appear shy and timid while another is aggressive. The child, as the adult, may act one way in one situation and differently in another. An individual accustomed to swearing refrains when talking to the minister. By the age of two years definite personalities have been developed. No two children live in the same environment even in the same family. Order of birth, sex, malnutrition, disease, and attitude of members of the family toward the child have their influences on behavior. The success of the

orthodontist in breaking habits and establishing new ones depends upon his ability to arouse an interest within the child; his ability to understand the different personalities; and his ability as a teacher of children.

The orthodontist is constantly confronted with the problem of the correction of habits which are harmful. While these are important, the helpful habits are of equal importance. All malocclusions, whether caused by habit or not, must be restored to normal function. To do this it is generally necessary to teach the patient the functional habits necessary to maintain the new occlusion. This is the secret of eliminating the relapse of treated orthodontic cases and is a subject of vast importance to orthodontics.

The correction of malocclusion when analyzed is the altering and making of anatomy, and anatomy exists only for function. Orthodontic treatment then should be considered only as a means to an end and that end must be normal function. Since all bones are plastic and alter their shape to comply with the demands made upon them, continued alteration and improvement can be expected after treatment has ceased, provided normal function of all associated parts exists. It becomes the duty of the orthodontist to produce a masticating unit capable of normal function, and to teach, when necessary, the functional habits for these parts.

The teaching of functional habits includes the use of myofunctional therapy as it is known today, correction of speech, deglutition, etc. Requirements such as correction of speech, diet, etc., should be referred to capable men in their respective fields.

A treated malocclusion must not be dismissed until it has been observed in function and the functional movements of the mandible and the associated parts are normal. This is the true test of completed orthodontic treatment. A beautiful intercusping of the teeth in centric relation is not the test of function.

CONCLUSIONS

Habit is an aptitude or inclination for some action, acquired by frequent repetition and showing itself in increased facility of performance or in decreased power of resistance.

Habit as related to orthodontics must be considered under two heads; namely, pernicious habits and functional habits.

In general, the control of habits, from the standpoint of either correction or formation, is an individual problem.

Motivation is of paramount importance in breaking old habits or in teaching new ones.

Mechanical appliances should be used to break habits only after other methods have failed.

The object of orthodontic treatment is to alter anatomy to permit normal function.

The teaching of functional habits is an important part of orthodontic treatment.

The test of a treated malocclusion is the normal functioning of the occlusion and its associated parts.

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AN EXPERIMENTAL STUDY IN GROWTH OF THE MANDIBLE*

Preliminary Report

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THE most compact accepted definition of growth and development is that growth is an increase in bulk, while development is an adaptation of that bulk to function.

It appears, therefore, that the former refers to spatial enlargement, while the latter deals with adjustment of growth increments to function through morphologic differentiation.

About thirty years before the published works of Sir John Hunter (1771), the use of vital staining in the study of bone growth was discovered. Since that time many investigators have made contributions to the literature which dealt with improvements upon the original technique, and also quite different methods of study, all of which have been designed to aid in the understanding of bone growth.

While some of these investigators have been concerned with bones other than those in the dentofacial area, those of us who are occupied with dental problems are particularly interested in the reports that deal with the mandible, maxillae and surrounding structures.

Considerable attention has been focused upon the mandible, its embryologic development, sites of growth, and the factors that influence its general method of approach to maturity and the decline therefrom.

It seems to be universally agreed that there is a genetic factor which predetermines the general form of the mandible, and to some extent its size, even throughout the life span of the individual organism. After that, certain intrinsic and environmental factors operate upon the organism so as to augment the genetic factors, and to effect an increase in size and attendant adjustment under normal circumstances. These factors also influence deviations from the normal which are found in pathologic conditions.

Baker,[1] in reporting a series of transplantations of embryonic mandibles of rats into the eyes, leg muscles and brains of other rats, states that "the mandible has increased in size by two groups of forces: one inherent in the germ-plasm and operating before birth; the other functional, and operating after birth."

Thoma[2] surveys the various hypotheses in this manner, " . . . by animal experimentation three theories have been developed regarding factors which augment inherent growth tendencies. These may be summarized as follows:

"1. The development of the jaws is due principally to occlusal force during mastication.

*From the Departments of Postgraduate Orthodontics and Oral Pathology, 1937-1938, Harvard University Dental School, Boston, Mass.

"2. The development of the jaws is governed principally by the development of the teeth.

"3. The development of the jaws is fostered principally by muscle activity."

Again, with regard specifically to the mandible, there is apparently no certainty as to whether the method of growth is interstitial or appositional in character, or both. Hunter,[3] Wallace,[4] Brash,[5, 6] Hellman,[7, 8] Keith,[9] and many others agree that growth of the mandible occurs through additional increments in stated localities (apposition), and is accompanied by resorption in other sites.

In contrast to these, Cryer,[10] Todd,[11] and others advance the hypothesis that mandibular growth is interstitial.

Representative of the adherents to the appositional belief is Wallace,[12] who may be quoted as follows: "Leaving out of consideration the growth of bone dependent upon the transformation of cartilage, all changes in its form and size appear to result from surface deposition and surface absorption. Any real evidence of interstitial growth *in formed bone* is lacking. Growth by deposition and absorption may be, and indeed has been, called true bone growth."

Brash[13] states that: "It has been generally believed, since John Hunter's original description of the growth of the mandible, that extension backwards of the ramus and simultaneous absorption of the anterior border of the coronoid process, though to a smaller extent, are sufficient explanation of the appearance of the molars from beneath its root, and of the slow increase in breadth of the ramus itself. . . . Space for the successive appearance of the molars from the root of the coronoid process is, I believe, obtained in three ways: (a) by the upward growth of the alveolar border carrying the teeth with it in relation to the sloping anterior portion of the coronoid process; (b) by the forward movement of the teeth themselves; and (c) by resorption of the coronoid process."

Hellman[7] says: "While not contributing to the growth of the organism, differentiation of tissues may produce increase in size of certain structures. Bones, for instance, increase in size as they continue to differentiate. But the addition of bone substance in one place is often accompanied by its removal in another. There is thus an adjustment in form, often bringing about a change in proportion. In the long bones, for instance, as bone is deposited on the surface of the shaft, it is removed (by resorption) in the marrow cavity. The jaw bones, too, present an illustrative example of this kind. The experiments on pigs fed with madder, mentioned in the paper by Brash,[13] will emphasize this fact."

Brash[14] also reports that: "Here we have a clear picture of the growth of the mandible by extension of its border in all directions, except along the anterior border of the coronoid process. The extension backwards of the ramus and upwards of the condyle is noteworthy, as well as the smaller additions all along the lower border. Kölliker determined the sites of resorption in the mandible of a newborn child, microscopically, by the presence of Howship's lacunae and osteoclasts; the two main areas, he determined, are situated in front of the coronoid and condyloid processes, and it is significant that he found also a small area of resorption on the back of the anterior end close beside the junc-

tion of the two halves. (The symphysis.) This seems to suggest that there is more in the region of the symphysis than mere anteroposterior thickening of the jaw; that there may be, in fact, a certain amount of growth forward at the anterior end, even in the human jaw."

Lundström[15] quotes Roux to the extent that "an interstitial or expansive development of this kind in a bone *can only take place so long as it is not calcified.*"

Cryer,[10] a supporter of the theory of interstitial growth, writes: "It is likely that the mandible grows by an interstitial process, each half having three fixed points between which growth occurs, viz., the ramus, the mental foramen, and the symphysis menti, or gnathion. There is no doubt that the distance between these points increases, though the growth between the symphysis and the foramen does not occur at the same time as that between the foramen and the ramus. The periods of growth in these regions seem to correspond with the time of development and eruption of the teeth in the localities concerned. Thus, the increase between the mental foramen and the symphysis menti occurs during the time the incisor, canine and premolar teeth are developing. After these teeth are erupted there is little increase in the length of this portion of the jaw.

"From the mental foramen to the ramus the increase is inconsiderable until the time draws near for the eruption of the second and third molars, the greatest growth occurring during the development of these teeth, and generally ceasing after the last named."

With respect to the angle of the mandible, he continues, "At birth the angle is very obtuse, but, as the teeth develop and erupt, it becomes less and less obtuse until, about the time that the last of the permanent teeth are erupted, it is almost a right angle. The difference in direction (angulation) is due to the general separation of the jaws by the growth of the alveolar process and the projection of the teeth into the space between them. As the teeth wear away, or when they are extracted, the process is resorbed, the horizontal planes of the jaws approach each other more closely and the angle again becomes obtuse."

Also on the subject of the angulation of the mandible during the process of growth and adjustment, *Quain's Anatomy* gives these statistics: "At birth, 140 degrees; at one year, 139.08 degrees; at three years, 135.81 degrees; at five years, 127.15 degrees; from six to eighteen years, 127.22 degrees; and during adult life from 120 degrees to 110 degrees."

Todd[11] believes that interstitial growth is characteristic of the jaws, and agrees with the belief that there is a change in relationship between the face and the cranium during childhood and adolescence that results in the face "emerging more and more from beneath the brain case."

Broadbent[16] advances the hypothesis that the coronal suture, the sphenoparietal suture, and the pterygomaxillary fissure uniformly fall in the same plane, and that this plane passes through the tuberosities of the maxillae and the junction of the body with the rami of the mandible. The process of growth he assumes to be analogous to epiphyseal growth and occurs anteriorly and posteriorly from this plane. Further, adjustment brings the anterior border of the ramus forward to the same vertical plane as that originally occupied by it before the growth process, as determined by cranial criteria.

It seems reasonable to select from the foregoing certain points of more or less common ground. Other phases are definitely in the realm of controversy. The realization that cumulative reports are not mutually affirmative should not incline one to be dogmatically adherent to any one hypothesis, but should stimulate further investigative procedures in an effort to crystallize substantiated ideas. As Sir Thomas Browne has written, "To purchase a clear and warrantable body of truth, we must forget and part with much we know."

Some of the points of affirmation seem to be as follows:

1. That the shape and general size of the mandible are genetically determined, and are influenced by both intrinsic and extrinsic factors.
2. That the extrinsic factors are developmental and functional in nature.
3. That there is growth in the horizontal, vertical and transverse directions which is accompanied by adaptive adjustments in the same planes.
4. That the mandible, like all other bones, is constantly changing in its adaptive capacity throughout the life of the individual.

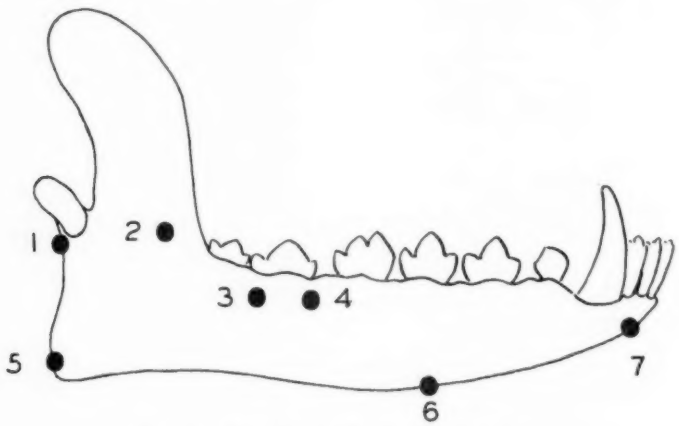

Fig. 1.—Position of pins at operation.

The experiment, reported below, is the first in a series in which, it is hoped, additional light may be thrown upon certain aspects of previous investigations. The technique is not new. The literature discloses that it was used by DuHamel[17] and later by Ollier[18] in a study of the method of bone growth in the long bones. Recently it was used by Proell and Wyrwoll[19] in studying the mandible in a manner very similar to that used in the following experiment.

The principal objectives in this study are:

1. To determine whether mandibular bone growth is interstitial, appositional, or both.
2. To determine the areas of maximum and minimum growth during the term of the experiment.
3. To record the extent of growth in the above areas by measurement.

The subject employed was a dog, aged four months, weight twelve pounds, a mixture of Collie and Dalmatian blood.

Under a general anesthetic, the right mandibular area was exposed, and seven steel pins were embedded by breaking the cortical plate with a burr and fixing the pins with a small hammer. (Fig. 1.)

Pin No. 1, in the posterior aspect of the neck of the condyloid process.

Pin No. 2, 1 cm. distal to the anterior border of the coronoid process just above the alveolar level.

Pin No. 3, 10 mm. above the inferior border of the mandible and opposite the first molar.

Pin No. 4, 11 mm. above the inferior border of the mandible and 6 mm. mesial to pin No. 3.

Pin No. 5, in the angle of the mandible.

Pin No. 6, in the inferior border of the mandible in the approximate region of the mental foramen.

Pin No. 7, in the lower border of the mandible in the region of the symphysis.

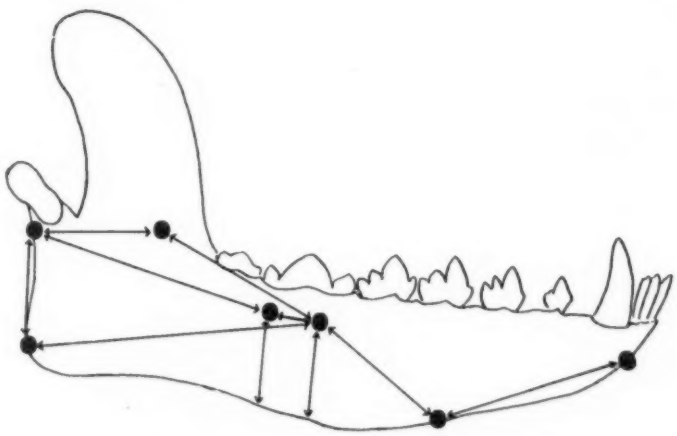

Fig. 2.—Sites of measurements at operation.

While the pins were exposed, the following measurements were taken with a Boley gauge (Fig. 2):

Between Nos. 1 and 2: 23.25 mm.
Between Nos. 1 and 3: 39 mm.
Between Nos. 1 and 5: 10 mm.
Between Nos. 2 and 4: 21.5 mm.
Between Nos. 3 and 4: 6 mm.
Between Nos. 4 and 5: 39.75 mm.
Between Nos. 4 and 6: 22 mm.
Between No. 3 and the inferior border of the mandible: 10 mm.
Between No. 4 and the inferior border of the mandible: 11 mm.

The wounds were closed by suturing, and healing was uneventful.

Periodical roentgenographs were taken in order to check the position of the pins with regard to any possibility of migration due to bone resorption around

them. No evidence of resorption appeared in Nos. 1 to 6 inclusive. Pin No. 7 was lost prior to the first roentgenograph, apparently by not being sufficiently secure at the time of the operation. (Figs. 3 and 4.)

One hundred and fifty-seven days after the operation the animal was sacrificed and the mandible recovered. (Fig. 5.)

The findings were as follows:

Pins Nos. 2 to 6 inclusive were stable in position but showed some evidence of bone resorption around them.

Fig. 3.

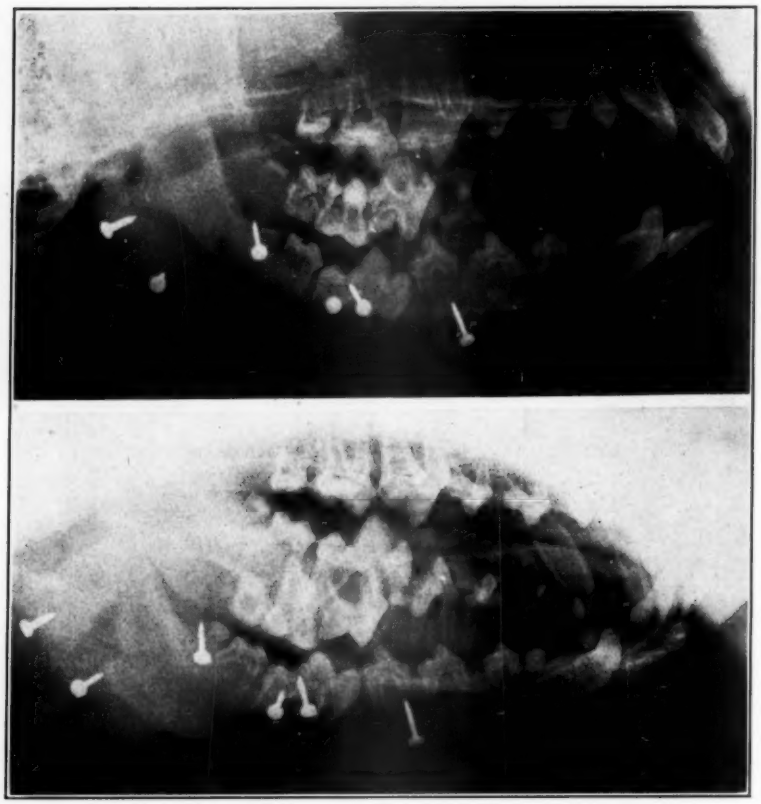

Fig. 4.

Pin No. 1 was loose, but sufficiently stable to serve for purposes of measurement.

There was no deposit of bone over the heads of any of the pins.

Measurements between the original landmarks were taken as follows:

Between pins numbered 1 and 2: 33 mm.
Between pins numbered 1 and 3: 46.75 mm.
Between pins numbered 1 and 5: 15 mm.
Between pins numbered 2 and 4: 21.5 mm.
Between pins numbered 3 and 4: 6.5 mm.
Between pins numbered 4 and 5: 44.5 mm.
Between pins numbered 4 and 6: 22 mm.

Between pin No. 3 and the inferior border of the mandible: 11 mm.
Between pin No. 4 and the inferior border of the mandible: 12.25 mm.

Pin No. 2 (formerly 10 mm. distal to the anterior border of the coronoid process) was now 6 mm. diagonally below the recently erupted third molar. The apparent resorption of the anterior border of the coronoid process at this level, therefore, is 4 mm.

Fig. 5.

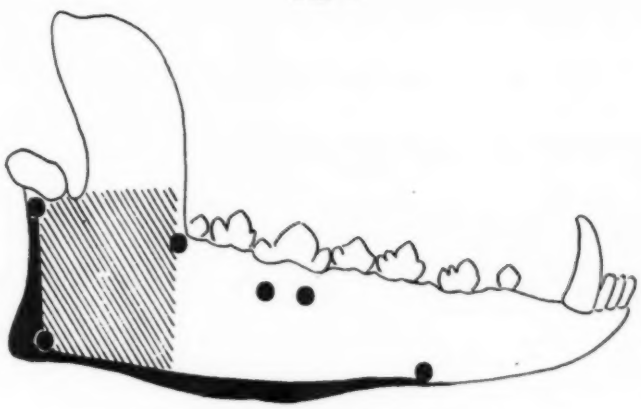

Fig. 6.—Areas of growth.

The eruption of the first molar was retarded by pins numbered 3 and 4. The alveolar bone about the first molar was not formed to the same horizontal level as it was in the same area on the unoperated side. On the unoperated side the total width of the mandible from the inferior border to the crest of the alveolus, in the bifurcation of the first molar, was 27 mm. On the operated side the height was 25 mm. The degree of arrested growth of alveolar bone was 2 mm. This, however, does not affect the measurements from pins numbered 3 and 4 to the inferior border.

The distance between pins numbered 3 and 4 has increased only 0.5 mm. Between pins numbered 4 and 6 the distance is unchanged. The posterior border of the mandible and the angle had extended 5 mm. distal to pin No. 5. The inferior border of the mandible had extended 1.5 mm. inferiorly to pin No. 6.

TABLE I

COMPARATIVE MEASUREMENTS

PINS	AT OPERATION	POST MORTEM
1 to 2	23.25 mm.	33.00 mm.
1 to 3	39.00 mm.	46.75 mm.
1 to 5	10.00 mm.	15.00 mm.
2 to 4	21.50 mm.	21.50 mm.
3 to 4	6.00 mm.	6.50 mm.
4 to 5	39.75 mm.	44.50 mm.
4 to 6	22.00 mm.	22.00 mm.
3 to Inf. border	10.00 mm.	11.00 mm.
4 to Inf. border	11.00 mm.	12.25 mm.

CONCLUSIONS

The extension distally of the posterior border of the ascending ramus and the angle of the mandible, in relation to pin No. 5, supports the hypothesis of growth by apposition anteroposteriorly of the ramus of the mandible.

The extension of the inferior border of the body of the mandible inferiorly to pins Nos. 3, 4, and 6 seems to support the hypothesis of vertical growth by apposition, as well as by growth of alveolar bone.

The difference between the operated and the unoperated sides, in total vertical height of the body of the mandible in the first molar area, indicates the importance of unimpeded eruption of the teeth and the stimulation offered by eruption and function to the deposit of alveolar bone.

The unaltered positions of pins Nos. 2 and 4, 3 and 4, and 4 and 6 indicate that for an animal of this stage of growth there is no active anteroposterior growth between the mental foramen and the vertical plane of the anterior border of the coronoid process.

The change in the anteroposterior position of pin No. 2 with relation to the anterior border of the coronoid process indicates a resorptive process in the latter which is important in the scheme of adjustment attendant upon anteroposterior growth.

The increase in dimensions between pins Nos. 1 and 5 indicates support to the hypothesis that there is an increase in vertical height of the mandible by lengthening of the height of the ramus itself and adjustment of its degree of angulation.

Perhaps the most important assumption is that the increased dimensions (Table I) between pins Nos. 1 and 2, 1 and 3, and 4 and 5 seem to bear out the conclusions of Broadbent[16] that there is growth activity at some point in the area between the anterior and posterior borders of the ascending ramus.

The loss of pin No. 7 prohibits any statement with regard to growth between the mental foramen and the symphysis menti.

SUMMARY

1. No anteroposterior growth occurred between the mental foramen and the plane of the anterior border of the coronoid process in this animal.

2. Resorption of the anterior border of the coronoid process occurred coincidentally with the extension of the posterior border distally and the eruption of the third molar.

3. Appositional growth was demonstrated anteroposteriorly on the posterior border of the ascending ramus and vertically on the inferior border of the body of the mandible.

4. Increase in vertical height was demonstrated in three ways: (a) by increase in height of the ramus; (b) by addition to the inferior border of the body; and (c) by extension occlusally through the growth of alveolar bone.

5. Extensive anteroposterior growth occurred within the substance of the ascending ramus. It is possible that pins Nos. 1 and 5 were placed in areas in which growth of an appositional nature was occurring and were carried along with the growth process. This would produce a change in measurements between these two pins and others in the series.

If their positions were not changed by such a process, then it appears that growth has occurred between them and other pins in the series. In the latter instance there would be support of the hypothesis of Broadbent, or perhaps of the adherents to the theory of interstitial growth.

6. The greatest amount of growth took place in a region in which the most powerful of the muscles of mastication have their sites of attachment. This supports the hypothesis of Thoma[2] that muscle activity is the most powerful extrinsic influence in development of the length of the jaw.

7. Perhaps both appositional and interstitial growth occur in different sites in the mandible, and at different periods of growth and development.

Further experiments will be conducted and reported. Animals of different ages will be used in an effort to produce a more complete picture. The animal in this experiment represents perhaps the oldest with which it will be attempted, since it appears to be possible to obtain more graphic results by using animals of a lower chronological and physiological age.

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654 GIRARD STREET N. W.

PRINCIPLES OF ORTHOPEDICS IN ORTHODONTICS

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ON FIRST thought the practice of the modern orthopedist and that of the modern orthodontist may seem to be worlds apart. But even a very casual survey of their respective fields of endeavor reveals that, in truth, they possess much in common. Historically, it is not without interest that Andry,[1] who in 1741 first used the word "orthopedics" and who was incidentally the first to stress the functional rather than the morphologic approach to the subject, described it as "the art of preventing or correcting the deformities of infants." Among these were included deformities of the teeth. On the other hand, Lefoulon,[4, 6] who is credited with first having delineated the branch of dentistry which is today called orthodontics, referred in his first article to "Orthopedia Dentaire" and later described "Orthodontoise" as "the treatment of congenital and acquired deformities of the mouth." Since those times, the scope of both these fields has been considerably restricted, and the more or less morphologic concept which characterized the early work has been modified and extended so as to include the more modern interest of function. Thus Angle[2] has defined orthodontia as "that science which has for its object the correction of malocclusion of the teeth." In a similar sense, orthopedics has evolved from the treatment of static, morphologic deformity of the bones, through the "treatment of deformities of the apparatus of locomotion,"[11] to the concept of the "treatment of deformities and functional disturbances of the postural and locomotive apparatus."[5] Instead of stressing the correction of deformity, the principal aim of the modern corrective surgeon has become the restoration of normal function. This does not imply a deprecation of the importance of the morphology of the involved structure. To do so would be to neglect completely the researches and conclusions of such workers as Roux and Wolff on the reciprocal relationship which exists between form and function. On the contrary, emphasizing the pragmatic and functional, rather than the esthetic and morphologic approach to the problems, has led to a fuller understanding of this work. It has been the mainspring of rational therapy and has documented the rapid progress made in both orthopedics and orthodontics.

In both fields the assiduous labor of countless workers has amassed a wealth of data in the details of which one may easily lose sight of fundamental principles. Stated in their general form these principles, few in number, will be found to apply with equal validity to orthopedics as well as orthodontics, provided appropriate particularization is made for the special conditions which each field presents. Viewed in this light, the orthodontist is primarily interested in providing or retaining an esthetic and efficient masticatory apparatus; the orthopedist in maintaining or re-establishing an efficient locomotive apparatus.

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Presented before the New York Society of Orthodontists, March 8, 1938.

Both are concerned with bones, muscles, vessels, nerves, and soft tissues, acting coordinately to energize lever arms, and so permit of motion at their fulcra, which are the joints. In the most general sense, it is the "joint" which is the fundamental unit of both orthopedic and orthodontic interest. It is at the joint surface that the effects of form are manifested; it is through the joint surface that the effects of function are mediated.

Among the joints of the body certain ones fall especially within the purview of the dental profession. In a manner of speaking, it may be said that the gomphoses of the teeth are the particular interest of the dentist, the temporomandibular joint that of the surgeon, while the occlusal plane is specifically the domain of the orthodontist. Though common practice has hallowed the term "articulation" in respect to dental occlusion, it has never consciously connoted the idea of a true joint. Anatomically, of course, there can be no doubt of the soundness of this usage. However, physiologically and pathologically, in its function as well as in its reaction to the forces which operate on other true joints, the occlusal plane may, with some justice, be defined as the articular surface of a physiologic, but non-anatomical joint. In this sense, it forms with the gomphoses of the teeth and the temporomandibular joints, a compound "oral" joint, analogous to the compound shoulder joint, which physiologically consists of the glenohumeral, the acromioclavicular and the sternoclavicular joints. Just as a defect in any one of the component joints of the shoulder leads to correlative changes in each of the others, so a variation in the form or function of any of the elements in the "oral" joint results in reciprocal adaptations in each of the other portions. It is inconceivable to contemplate a surgical modification of any portion of this complicated mechanism without at least an effort to evaluate its more remote physiologic effects.

For some totally inexplicable reason, physicians, and dentists, too, frequently forget that in essence they are biologists studying the reactions to various stimuli of the animal called man. Particularly surgeons are liable to err in this regard. Trained as they are in the exercise of manual efforts, they frequently acquire a purely mechanistic attitude and overlook or disregard the fact that they are dealing, not with inert matter, but with an exceedingly variable substance, the tissues of the human body. Despite the common belief to the contrary, the bones and joints, particularly in youth, are extremely labile structures immediately reacting to any disturbance in the system of stresses under which they had taken form. No matter how cunningly a technical procedure may be conceived, it is from the outset doomed to failure unless it takes cognizance of the forces which growing bone exerts and to which its growth is subject.

This varies, of course, with the age of the patient. In youth, it represents a true metamorphosing power; in older age, it becomes converted more into a reparative force. The consequence is that mechanical procedures designed adequately to meet the indications of the postadolescent period may give bizarre or even unsatisfactory results when applied without further consideration to the preadolescent period. Where the deformity in a growing child is not too great, a very marked correction may confidently be expected from the

normal growth process. It is not uncommon to find both in the jaw and elsewhere deformities which correct themselves without any external efforts. The question necessarily arises as to when corrective measures need be instituted. This involves an estimation of the extent of the deformity or disability and a correlative study based upon long and minute observation of the rate and the nature of the growth changes at different age periods. The inability to gauge this factor carefully may, on the one hand, result in the unnecessary performance of technical procedures, or, on the other hand, vitiate our best efforts. The failure to recognize the action of this force may leave us mortified in the face of well-aligned, but rootless teeth, or humble us after a successful operation from the effects of which the patient dies or remains permanently maimed. As surgeons, we must appreciate the fact that we are merely craftsmen and can affect our patient purely by the methods of rational mechanics. As physicians and biologists, we must realize that our efforts will be modified, enhanced or nullified, by an unreasoning, but well-ordered vital activity, which we can hope to control only through the application of biologic principles. Even at the risk of becoming bromidic or boring, the constant interplay of these two forces and the necessity of developing a biomechanical, rather than a mechanical, attitude, must be stressed.

Any progress in arriving at a correct biomechanical concept can be predicated only on a careful analysis of the mechanics of the biological or mechanical forces operating at any given point. Though this may appear simple enough, the problem is extremely involved and has led to much difference of opinion. Let us take, for example, the effect of pressure, with which in particular the orthodontist is concerned. Much ink has been spilt in the attempt to evaluate the significance of this force on the growth processes of bone. Some authors have expressed the opinion that the effect of stress is atrophy and growth hindrance. Others have insisted, on the other hand, that stress leads to hypertrophy and stimulation of growth. In an attempt to reconcile these apparently contradictory conceptions, Müller[8] pointed out that the former is true as regards the growth in length of endochondral bone, and the latter holds true with respect to the hypertrophy of activity and the atrophy of disuse.

While this may represent part of the truth, it by no means completely resolves the difficulty, since it makes no mention of a time element. That this is a not inconsiderable factor must be readily admitted. In some instances relatively intense force applied for a short time may yield no harmful results, while in others comparatively mild forces, more continuously applied, have led to distressing effects. Thus, in a series of cases of spinal tuberculosis treated at the Hospital for Joint Diseases, and in another series of scoliotic cases, treated elsewhere, noticeable deformity of the mandible was observed following the constant use of head traction, or braces equipped with chin supports. Upon removal of this form of pressure, marked improvement and resumption of natural growth occurred. In a similar sense, the continuous force exerted by a firmly fixed steel spring must and does act to cause a resorption of the root and root supporting structures. Ideally, intermittent force or a mild elastic force would be preferable, but since the use of the steel spring appears more expedient, par-

ticular care should be exercised to determine the biologic response of the periodontal tissues. In the event that the balance between the corrective force and the tissue reparative force is disturbed, immediate discontinuance, or at least reduction in the intensity, of the corrective force, is vital. Which of the two methods is to be employed depends entirely on the biologic response in any individual case. This is true, even in regard to the relatively constant pressure exerted by the normal periarticular musculature. The fact that motion constantly occurs, that different portions of the joint surface are successively subjected to the effects of muscular action, serves to convert the continuous muscle tonicity into an intermittent force, devoid of the danger of pressure atrophy.

Of the fundamental processes involved in the formation or function of joints, relatively little is known. Probably, as a result of hereditary influences, the form of the articular surfaces is determined in utero, before motion of the extremity occurs. In later development, however, motility is a potent factor in maintaining the form as well as the function of the joint. Experience indicates

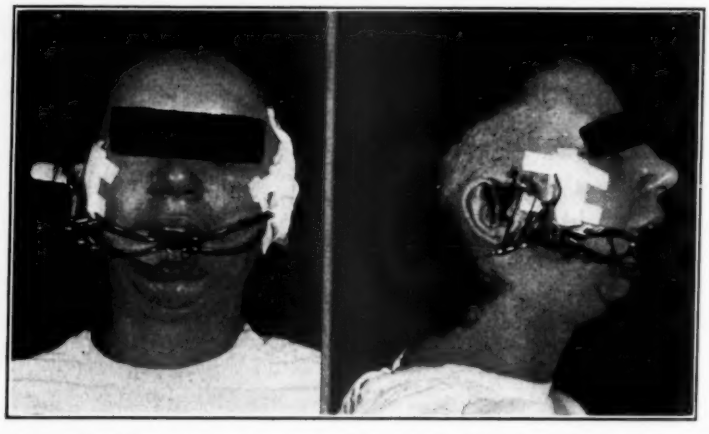

Fig. 1.—Demonstrating the use of the Whitehead mouth gag to utilize elastic traction immediately after motion has been restored to the ankylosed mandible. The ratchet has been removed, and in its stead elastic bands have been slipped over the lever ends of the gag.

that, histologically, metaplasia of the connective tissue into a flattened endothelial-like surface is at the basis of this process. This occurs under the influence of the constant change of balanced force, which characterizes motion. Where motion is partly limited, particular areas of the articular cartilage are unduly stressed and undergo an atrophy and malformation, which may, in part, be attributed to the abnormal action of the periarticular muscles. Where motion is entirely absent, the joint surface gradually becomes covered by a pannus which later organizes and may ultimately lead to complete ankylosis.

The significance of loss of motion is illustrated in the temporomandibular joint, probably better than in any other joint. In addition to the interference with mastication, in addition to the problem of dental caries, there is invariably an associated interference with the normal growth of the mandible and the occlusal plane, which presents serious therapeutic difficulties, even if and after motion is regained. In a patient on whom I recently operated for a bilateral recurrent temporomandibular ankylosis, a fairly satisfactory result as regards motion was achieved. From a technical point of view, the successful outcome

was to be attributed, not to the interposition of fascial graft, but rather to the extensive resection of the condylar processes and the careful attention to the postoperative muscle re-education. (Fig. 1.) However, despite the fact that the patient is eminently pleased with the improvement obtained, she is still left with a marked deformity. This is due partly to an open-bite and partly to the mandibular recession which might have been avoided had earlier and more persistent attempts at surgery been successful. From this consideration alone, it would seem that delay in the treatment of this condition is not justifiable. In view of the assurance of deformity, restoration of the function of the temporomandibular joint should be sought at the earliest possible moment.

It is from the contemplation of difficulties such as this patient presents that the problems of rational therapy arise. Since the form and the function of the normal joint must be predicated upon a normal balance of the active forces about the joint, it is obvious that from a practical point of view our main concern is with those imbalances of force which are the basis of the pathologic joint and which are amenable to correction. As in any other system of physical forces, biomechanical forces exert different effects, depending not only upon their intensity, but also upon the angle of their application. The imbalances caused by variations in intensity are usually due to the soft tissues. The imbalances due to variation in angle of application of the force are most commonly of bony origin.

The soft tissue imbalances may be either relative or actual. In the former case, where mild muscle or capsular contractures exist, forcible stretching has been recommended. This method, though frequently effective, must be used with great circumspection. Besides the danger of producing a fracture in the adjacent and often atrophic bones, forceful manipulation may lead to more pronounced limitation of motion, either as a result of muscle paresis brought about by overstretching, or as a result of increased fibrosis, due to partial tearing of the soft tissues. A far less dangerous means of accomplishing the same end is that which employs the principle of balanced or elastic traction. Although less spectacular in appearance, the benefits obtained by this method may be far more lasting in effect. In the more resistant cases, in which an actual imbalance is present, open operation is to be preferred to repeated forcible manipulation. These include the various types of capsular incisions or strippings. For the muscles, they include muscle strippings, tendon shortening or lengthening, and, in suitable cases, muscle transplantations. While the fundamental attitude of the orthopedic surgeon is to utilize without sacrifice those structures left unaffected by the pathologic process, there are instances where the balance of forces can be restored only by nerve resection and the production of what may be called a partial differential paralysis. In any event, the objective must be, and always is, the correction of imbalance.

This guiding principle acquires validity only if the underlying bony structure is relatively normal. The maintenance of the normal plane of a joint is the sine qua non of efficient symptomless function. Where a joint line develops at a relatively abnormal angle, the adjacent structures may, by variation in form and function, adapt themselves in a symptomless manner, provided the

imbalance is not beyond the limit of biologic response of the tissues. Where this limit is overstepped, as in malaligned fractures or in the edentulous mouth, pains, deformity, and ultimately inflammatory reactions may occur in the neighboring joint structures. From the fact that internal stresses must be present, even though the contour of the organ may appear grossly normal, the necessity for the correction of a deformity at its site would seem to be self-evident.

Possibly because nature attempts the correction of one deformity by the creation of an opposite compensatory deformity, the surgeon has frequently adopted a similar and often unjustified attitude. Expediency may condone or necessitate such procedures, but they should be undertaken with the clear realization that they do not obviate the likelihood of subsequent disability. All will readily agree that in a case of knock-knee due to a deformity in the tibia, the creation of an opposite curve in the femur would hardly meet the indications for treatment. Yet, in a case of open-bite due to a combination of short ramus and increased mandibular angle, it is not uncommonly recommended to perform an anterior transverse osteotomy, or to remove an anterior wedge,

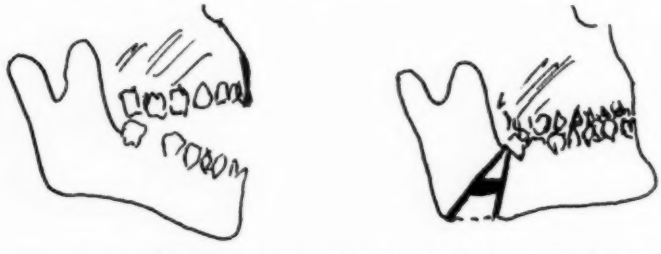

Fig. 2.—A case of open-bite for the treatment of which removal of a wedge base up from the area just in front of the first occluding tooth has been recommended. The objection to this type of procedure is shortening of the mandible. On a cardboard model it can be demonstrated that opening of the wedge base down efficiently corrects the malformation without shortening the jaw. The oblique osteotomy through which this can be effected should extend from in front of the first occluding tooth backward and downward to the place where increased angulation of the mandible occurs.

for the purpose of transposing or angulating the incisor fragment upward. With limited experience in this field, one should not venture a criticism of these procedures. On a priori grounds, however, it would seem as if an oblique osteotomy, opening a wedge at the angle, rather than removing a wedge on the opposite side, might serve to correct the deformity without any resultant shortening of the body. (Fig. 2.)

The determination of the degree and site of a deformity and consequently of the correction which is necessary, can be made only with reference to an established norm of bony relationships. In the leg, the upper and lower tibial articulations must be relatively parallel to each other and to the ground, while the axis which connects the two articular surfaces must be approximately perpendicular to each. In the mandible, one might venture the suggestion that with the mouth closed the teeth should stand normally in relation to one another, while the mandibular angle should approximate that which is standard for the age group. Once the case has been carefully analyzed, with especial attention to the exact location of the primary deformity, a cardboard outline of

the x-ray profile of the bone may be made. With this as a working model, a fairly accurate estimation of the type of osteotomy indicated may be made.

Many different varieties of osteotomy have been described. The linear L-shaped and V-shaped are useful in the correction of uniangular deformities. The "high hat," the curved, and the splintering subperiosteal osteotomies are valuable in multiangular deformities; while the Z-shaped has particular merit in bone lengthening or shortening. Each has its own particular merits for special conditions, the details of which are not important for the present discussion. But here, again, too much must not be expected from the simple cutting of a bone. Regardless of the form in which the surgeon may leave it, the ultimate result will be modified by the forces acting upon the bone, just as the root of a seedling will inevitably turn downward in response to the force of gravity.

Neither the orthodontist nor the surgeon must ever lose sight of the fact he is dealing not with a bone or a muscle, but always with a living bone and a muscle—a biologic unit in which each of the forces is acting reciprocally to modify all the other forces. While the unhappy outcome of a complicated mechanical procedure may occasionally be laid to a technical error, it may quite as frequently be attributed to improper evaluation of the biologic forces constantly acting in a given situation. It is only by the careful analysis of the exact nature and localization of the primary imbalance, it is only from correction of the imbalance at this point rather than elsewhere, that successful resolution of the difficulties can be confidently expected. This implies the dropping of the purely mechanical and the assumption of the completely biochemical approach. It is from this vantage point, gained through the painful and painstaking acquisition and formulation of broad general principles, that the fundamental problems inherent in both our fields of endeavor can be adequately surveyed and solved.

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225 WEST 86TH STREET.

DISCUSSION

Dr. Sidney E. Riesner.—I am particularly gratified to have had the opportunity of listening to Dr. Milch. His paper illustrates very well the value of inviting those interested in collateral sciences to consider our joint problems and to correlate some of the work of orthodontics with its medical father. It is interesting that an orthopedic surgeon should

offer us such a novel and interesting consideration of occlusion. I wonder whether you listened carefully to Dr. Milch's presentation and heard him tell of his belief as to what the occlusal forces of the teeth were in his consideration of function. It is a very beautiful illustration of the application of function as a controlling force for form. It is surprising how accurately Dr. Milch enumerates the fundamental laws on which orthodontics must be practiced, but they are universal laws, and they are not peculiarly limited to our specialty. I venture to say, if Dr. Milch felt so minded, that he could probably engage in orthodontic practice with a much higher degree of success, and with much less study of our particular problem, than some of us, for he is marvelously gifted. I should like to help emphasize the value of an invitation of this sort as a means of enlarging our views in the consideration of our practice, to make us realize that it is not confined only to the mouth, but that the mouth is just a part of a larger structure of the human anatomy and is based on laws that work all over.

Dr. Frank A. Delabarre.—I feel utterly incompetent to criticize the larger aspects of the subject which was presented to us by Dr. Milch as relating to the surgical part of the picture. I did feel that when those operations on the jaw itself were performed, with occlusion present only in the posterior molar region, with an attempt to correct it by correcting only the malformation and distortion of the mandible itself, without sufficient consideration to the subsequent function that would result from the surgical placing of those teeth in occlusal relationships, that that was a mistake. I do appreciate fully the logic in combining not only form but function in the case of the surgical operation on the mandible where the form was correct as ever it might be; but when we consider function there we have to consider not only the function of mastication but the balance of all the functions immediately concerned, among which is the function of the tongue. In those cases of gross distortion in the outlines and relationships of the mandible, the tongue plays a most important part, and it would seem to make the cavity which encloses the tongue too small for it to function properly. The tongue may have been responsible for the gradual opening of that bite and occlusion only on the posterior teeth. When that bite is corrected surgically, the area in which the tongue can function is too restricted for it to function normally, and I should look for more or less of a return in the bending of the mandible again.

Dr. Strang.—There are two phases of the paper that were particularly interesting to me. One was the study of the forces that play upon the bones. That leads us in our own field to understand more thoroughly the forces of occlusion. To my mind, no orthodontist is practicing intelligently until he has become thoroughly familiar with the stresses and strains playing upon the nasal bones as a result of functional forces. The change in the bones after operation, when they were placed by the doctor to take certain weights, and the rearrangement by nature in order to sustain those weights correctly, were exceedingly interesting.

In closing his paper Dr. Milch had a combination of deformities to correct, and brought out the fact that each one of these deformities must be corrected in its own area. We have, in turn, a combination of deformities within the organ of mastication, and we cannot hope to obtain complete success if we overlook any one of the areas that are at fault. How many of us have left our cases with too little corrective movements in certain areas, and particularly with a failure to correct overbites? We cannot hope for perfect results if the arches are too narrow, if the axial position of the teeth is incorrect, if the overbites are too great. Those two lessons were particularly interesting to me.

Dr. Henry Milch.—There is very little I have to express except to thank Dr. Strang and Dr. Delabarre both for having so accurately expressed exactly my attitude. I did not hope to enter the field of orthodontics or even to venture an opinion; I realize that I am completely out of my depth.

The suggestion that I made about the osteotomy of the mandible was made with a great deal of temerity. I am perfectly willing to withdraw it immediately, except as indicating that it is merely one of the combinations which Dr. Delabarre discussed, and it is merely one of the factors that must be considered. Of course, the tongue, and similarly

the occlusal plane, the molar occlusion, the temporomandibular joint, and all the muscles that have to do with the growth or development, with the form or the function of the mandible and the superior maxilla are involved. When we make an effort to correct any one of these, it is only with the distinct understanding that all the others are going to undergo certain changes, which must be in a proportionate degree taken into consideration, and possibly changed again or re-educated or remodified to accommodate to the new position. When we make any change in any of these factors, we cannot hope for an immediate and accurate accomplishment of the goal we have set out for, because that, too, will change in proportion to the growth or in proportion to the other forces still acting. The problem that I wanted to touch upon was merely to indicate the complexity of the task, and the fact that no one method is *the* exact approach. We must approach it as biologists and do a little at a time, and do it at the place where we expect the greatest benefit, and then sit back and watch to see and modify again, if need be. We are dealing with growing tissues, and they all change as they are modified.

As for Dr. Riesner's very complimentary remarks, I can only say that I have had occasion to meet Dr. Riesner outside of his professional capacity. I have enjoyed the talks I have had with him, and I am sure I have learned more from him than he has from me.

A CONSIDERATION OF THE BITE PLANE AND ITS DEVELOPMENT

HARRY E. KELSEY, D.D.S., F.A.C.D., BALTIMORE, MD.

THE fact that the bite plane has been the subject for the presentation of papers before the Southern Society of Orthodontists in February, 1938, and before the New York Society of Orthodontists in March, 1938, and was suggested to me for a talk before the Washington-Baltimore Society only a month later, would seem to indicate that there is a renewed general interest on the part of the profession in this appliance and its various adaptations. In this paper I shall refer to it as the "bite plane" because this term is descriptive of the functioning part of the appliance and is applicable to all forms, those which are actually plates with a biting plane or surface either flat or inclined attached to them as well as those which are merely planes secured in their functioning position by means of a lingual arch or some other form of attachment.

My own experience is probably similar to that of other orthodontists with a fairly long record of practice. It is that, at one time or another, the need for overcoming certain very difficult problems inspires a search for a means to an end. As a result of this, many orthodontic appliances have been frequently resurrected or reinvented, and this has probably occurred more times with the bite plane than with almost any other of the appliances which have become standardized and are in general use today. Most of the older practitioners can remember the experience of having some appliance or some modification of an appliance enthusiastically demonstrated to them at some clinic as a unique and original idea which they themselves have used for years and in some instances possibly discarded. Were this not so, many good things would be lost to the profession, because even though publicly shown and demonstrated they may have been completely forgotten by the majority of practitioners. There are not very many basic inventions produced in one year in any field but innumerable useful modifications appear which must all be given credit as having a part in developing the original basic idea into its most useful application. Of no orthodontic appliance is this truer than the bite plane. Its wide use today deserves a thorough search of the dental and orthodontic literature for its first appearance and for the numerous modifications and adaptations which have been shown during the last fifty years. There has been more than one period during which it fell into disuse and suffered the severest criticism, often by men of high standing.

In the earlier days it was always a removable appliance, a plate, and no doubt on this account it fell into disrepute along with other removable appliances, but in one form or another it has always cropped up; and, as I said in the beginning, there seems now to be a sort of bite plane renaissance during which it is widely met with on the clinic table or in program titles.

Read at the meeting of the Washington-Baltimore Orthodontic Society, April 21, 1938, at Baltimore.

Since I was asked to present a paper on the bite plane, I have not had the time nor perhaps the willingness to make a completely exhaustive search of all the literature, and I promised only a résumé of the evolution of the bite plane as I know it myself. In other words, to touch on such periods of its popularity as I was familiar with during my own lifetime as well as other periods previous to my own experience but about which I have gathered some information. I, therefore, do not regard this paper as a finished product, and I may unintentionally fail to give credit to someone who has aided in keeping alive the usefulness of this appliance or helped to resuscitate it after a period of almost complete coma.

From a practical standpoint, I believe the form of bite plane used and described by Dr. Norman Kingsley,[1] and probably by others before him, marks the period in its evolution at which it became really useful to the orthodontist and presented possibilities which are being realized to the present day. Dr. Kingsley claimed to be, and was so far as I can discover, the originator of the method of using the steep bite plane to correct the anteroposterior malrelation of the maxillary and mandibular teeth in patients presenting what we now term a Class II or distoclusion. He termed the operation at that time "jumping the bite," and I have heard Dr. Bogue discuss it with other practitioners of the day when I was a student in his office in 1895. The feeling at that time was well established in the minds of some that it was not a successful operation and that the great hopes that had been entertained for it were not being realized. On the other hand, there were those who regarded it as a revolutionary achievement and possessed of unlimited possibilities. As it was at that time relied on entirely to bring about the correction of a distoclusion without the aid of intermaxillary force, which had not yet been introduced, it is not surprising that it failed of its object in so many cases as to discourage practitioners generally. I have heard that Dr. Kingsley had rather signal success with it. Probably this was due to the fact that he knew better than most practitioners which cases were amenable to such treatment, for there certainly are a few Class II cases which can be successfully treated with the bite or guide plane exclusively, that is, without the aid of intermaxillary elastics; and we all know there are some distoclusion cases which practically correct themselves when all interference is removed.

In reviewing the literature in the seventies, eighties, and nineties, Dr. Kingsley's name is constantly met with either as the author of books and papers or in the discussions of papers by other men. It is rather noteworthy also that he either developed appliances or referred to the development and use by others of appliances which many of us have believed to be quite new. He was a prolific writer and did an immense amount of practical investigation. He describes the bite plane and its use in his book *Oral Deformities* published in 1879, where he says, "It was adapted to the inside of the superior dental arch and the inclined surface marked *A* projected below and caught the inferior incisors. The object was, not to protrude the lower teeth, but to change or jump the bite in the case of an excessively retreating lower jaw." He also drilled holes through the plate from the palatal surface out to the anterior margin through which small elastic bands were carried from a hook fastened

in the plate to be looped over a small flat bar which was adapted to the labial surfaces of the anterior teeth. This was for the purpose of retracting these teeth independently of the rest of the dental arch. He says, "The fixture was worn constantly and in a few months produced the desired result. The objection urged against the use of an incline, because the time required had a tendency to alter the articulation of the teeth, was in this case an argument in its favor, and an advantage, because a new articulation was desired, and the incline, as adapted, offered no opposition to the antagonism of the teeth." One finds in the literature of the succeeding years many allusions to "jumping the bite," many of them by Dr. Kingsley himself. In 1903, in discussing a paper by Dr. H. A. Baker,[2] in which he described his use of intermaxillary elastics, Dr. Kingsley said that his greatest satisfaction at this time was that the question of jumping the bite seemed to have been universally accepted and settled. He believed that he was the first person who ever adopted and then carried out that principle of correcting malocclusion of the jaws, and that the term originated with him. That twenty-five years or more ago he had corrected a case in a very brief space of time and was exhibiting models of the result at a meeting of the Odontological Society. Someone asked how it was done, and Dr. Kingsley answered on the spur of the moment that he "jumped the bite." The phrase was taken up, the method discussed, and the facts were disputed for many years, notably by Dr. Talbot of Chicago. Therefore all the gentlemen could appreciate the pleasure it gave him to see that the principles had not only been accepted but the method of accomplishing it improved upon by Dr. Baker.

Dr. Farrar[3] in his *Irregularities of the Teeth and Their Correction,* published in 1888, refers briefly to the bite plane and describes a number of its applications for the movement of individual teeth; but so far as I could find, he does not allude to Dr. Kingsley's use of it to jump the bite and correct a distoclusion. Glancing through Dr. Farrar's book, however, one is struck by the fact that he devotes a good deal of space to the result of his research into the question of constant versus intermittent force, a theme that has recently been opened again by Dr. Albin Oppenheim[4] in a paper published in the *Angle Orthodontist* in 1935 and 1936. In a paper read by Dr. Milo Hellman[5] before the annual meeting of the Great Lakes Society of Orthodontists in Toronto, October, 1936, he says, "Oppenheim points to the fact that repair occurs when the force exerted is interrupted by intermittent resting periods. For example, when using the expansion arch and ligatures, Oppenheim found that tissue repair occurs during the intervals between the tightening up of the ligatures. When, however, springs are employed, as is done in connection with the lingual arch, the force is continuous and repair does not occur as long as it lasts." I predict that what Farrar has written on this subject will be reread with a good deal of interest. It may be another case in which a principle discovered and recognized long ago is brought to light again and verified by actual physical research and accepted as the most modern concept in regard to an important problem in treatment and is analogous to the frequent reinvention of the bite plane and other appliances previously referred to. Dr. Farrar regarded the force exerted by bite planes as being of an intermittent character, as indeed it is, except where

a spring having been inserted in the plate exerts pressure on a tooth or teeth. Notwithstanding what I have just said in the above slight digression, I shall continue to employ springs very extensively in the future as I have in the past and that is a great deal because while their action upon the tissues may be slightly different from intermittent force such as may be applied with a screw, I think it is yet to be shown that they have any harmful effect, when properly used, upon the tooth or its supporting structures.

Angle[6, 7] in his "Sixth Edition" does not mention jumping the bite but does refer to Baker's anchorage which may be used for correction of mesiodistal malrelations instead of resorting to extraction of teeth. In his Seventh Edition he, of course, describes fully the Baker anchorage and its use and, as we all know, condemns extraction under any circumstances.

C. S. Case[8] in his *Dental Orthopedia* published in 1908 says, "In all cases of marked disto-mesial malrelation of the upper and lower teeth one should always strive to prevent being deceived by a facial effect. Where the mandible and contained teeth are decidedly retruded in their esthetic relations, the effect is usually that of any upper protrusion even when the upper lip is nearly or quite in normal relation to the balance of the features of the physiognomy.

"For the perfect correction of occlusion and facial outlines, cases of this type really demand the operation known as 'jumping the bite' which was introduced by Dr. Norman Kingsley in 1882. This consists in attaching an apparatus to the teeth, intended to force the lower jaw forward the desired distance, and to hold it there until nature has so changed the temporomaxillary articulation as to render it impossible for the jaw to ever go back to its original position.

"In the *Dental Review* of May and July, 1894, will be found a complete resume of the literature of 'jumping the bite,' with the author's description of the difficulties which would need to be overcome in a successful operation of this character, the whole intended to show the improbability of permanent success. After repeated and long continued trials to 'jump the bite' with the most skillfully constructed apparatus, for a number of patients younger than 13, all of which ultimately were failures, and moreover as he has never seen from the hands of others a well authenticated case of correction by this method, the author now regrets to say, notwithstanding the operation has been recommended as practicable by a number of prominent orthodontists, he cannot advise anyone to under take it."

It is evident that the introduction of the Baker anchorage or intermaxillary elastics, which provided a method so much more reliable for correcting mesiodistal malrelations, had by this time led the entire orthodontic specialty to discard the inclined bite plane as a direct means to this end. When I attended the Angle School of Orthodontia in 1908, "jumping the bite" by means of an inclined plane was already considered archaic, and the profession was reaching the height of its enthusiasm for intermaxillary force. Being discarded for one of its most important uses, that of "jumping the bite," the bite plane fell into disrepute, but not for long.

In 1911, Alfred P. Rogers,[9] of Boston, read a paper before the annual meeting of the American Society of Orthodontists, in Boston, entitled "The Use of

the Inclined Planes in the Correction and Retention of Malocclusion." In it Rogers says, "Kingsley, I believe, was the first to use the device known as the inclined plane, to 'jump the bite,' as the correction of distal occlusion was termed at that time. Dr. Ainsworth has been an advocate of the inclined plane and has developed its usefulness to an important degree.

"Although the inclined plane has long been used for the correction of malocclusion, its application has been so frequently misinterpreted and its construction so faulty that there have been many failures following very promising first results. It is my object to describe as nearly as possible the construction of the apparatus which in my experience has proved most valuable."

Rogers goes on to describe his modifications and adaptations of the bite plane which were then quite unique, and his paper did a great deal to re-establish the bite plane again in the good graces of the profession. In the discussion of Rogers' paper, Moorehouse, Young, Ottolengui, Pullen, Weeks, Dunn, Ketcham, Lischer, and Bogue all commend it and describe many individual ways in which they themselves had used the bite plane. To any one familiar with the standing of these men, this is a very important recommendation of its usefulness in orthodontic procedure, and it has been more or less in favor ever since. My first acquaintance with a bite plane attached by means of a lingual arch to molar anchorages was made in the office of Dr. J. Lowe Young, who showed me a very neat appliance. Whether he called it a filagree bite plane or not, I do not remember, but I adopted this name in my own practice and have used a good many of them ever since. Whether Young or Herbert Pullen first used this form of the bite plane, I do not know. They were attached by means of the Young angle lock, which is, as you know, the lingual vertical or slightly inclined tube. The inclined plane itself was constructed by attaching a bow from one side of the anterior portion of the lingual arch to the other which projected downward far enough to insure the desired height for the plane. From this bow to the anterior curve of the lingual arch small straight or diagonal wires were soldered. This made an open work plane down which the mandibular anterior teeth could slide as the mouth was closed, but by having so much open space between the wires, food and liquid could pass through quite readily so that the gums underneath received a more or less normal stimulation while the patient was eating. Some of the bite planes Rogers described, or in fact most of them, were cemented to the anterior teeth, but so far as I know the filagree bite plane described above was the first fixed removable bite plane to be used. When I advocate the use of any appliance which depends for its attachments on the lingual vertical tube, I always think of John Mershon,[10] for it was he who conceived the idea of using it for the attachment of the lingual arch wire which is the basis of practically all fixed lingual appliances today.

In 1913, Strang[11] described the construction and use of vulcanite bite planes according to a modification of his own. They were designed for opening the bite in those deep overbite cases which have usually been responsible for a resurrection of the bite plane when it has fallen into disuse. His presentation contained many valuable uses and suggestions, one of the most important being his method of attachment, especially in cases where the deciduous teeth were still present and the anatomy of which, as we all know, affords a poor shape

to be engaged successfully by the clasp of a plate. He placed bands on a deciduous molar on either side, and on the buccal surface soldered a vertical bar in which he cut a notch near the gingival end. When the plate was pressed into the mouth, the clasp snapped into this notch and held the plane securely. I have used a few of these in cases where I could not obtain good retention by a simpler method and it is very satisfactory. We often have cases also in which the bicuspids do not protrude far enough from the gums to engage a clasp successfully. It is equally useful in those cases.

The next step in the development of the bite plane, at least to my mind, must be credited to Hawley,[12] who in 1919 described the construction and use of a retaining plate which he said was a modification of the McBride plate. I should therefore say that some of the credit for this very useful and widely used retainer with its modifications and combinations should be given to McBride, who was then practicing in Berlin. However, because Hawley was the one who showed its superior advantages for retention and made such modifications as seemed to establish its practicability for use in the hands of the rank and file of those practicing orthodontia, it soon became known as the Hawley retainer and probably always will and should be so known. The close connection between this appliance and the bite plane arises from the fact that soon after its introduction a great many men began to use it in conjunction with a bite plane, that is, an inclined bite plane was added to the retainer in its construction. Whether Hawley or some one else did this first, I really do not know, but he showed this appliance and reported numerous cases in which it had been used, and developed modifications which (with perhaps some modifications designed by others) have made it one of the most universally used orthodontic appliances in the country and indeed throughout the world.

About 1929 or 1930, Oren Oliver[13] read a paper in which he described what he termed the guide plane, which consisted of an important modification of the filagree bite plane. This modification was based on the principle of attaching the inclined plane to the lingual arch at a point which was compatible with the mesiodistal relations of the upper and lower arches and then gradually moving it forward as the mesiodistal malrelation was overcome. It thus served not only as bite plane and retainer but also in the capacity of the old Kingsley inclined plane to move or "jump the bite" forward. Since Oliver's paper there has been so much written and published on the bite plane that it would be impossible to include all of it here, but there is one modification to which I wish to call your attention. I do not know whether Andrew Jackson[14] of Philadelphia designed and first used this modification, but it was from him that I got the idea. I am referring to a fixed inclined plane attached by means of a lingual arch. We have all had cases where we wished to use an inclined plane, and I recall one case within the last year in which the patient could not be depended on to wear a removable appliance; and the fixed bite plane, as an alternative, could not be inserted in the form I had always used it without causing irritation of the lingual gum tuft between the central incisors. About this time I saw Jackson's adaptation, to which I referred, which proved to be very helpful. There is no difference in the principle of influencing the teeth and jaws, but the construction is adapted to the type of case just referred to. Instead of passing

the lingual wire around near the gingival margin of the anterior teeth, it is carried forward about to the canines, then raised to the height of the desired inclined plane. To this, round or flat wires are soldered, extending downward and forward to the incisors and cuspids if needed, easily avoiding contact with any gum tissue. It is such little modifications as this that make almost any type of appliance a valuable adjunct in treatment, and failure to overcome some such difficulty often leads one to discard an otherwise valuable instrument.

Another ingenious and valuable modification of the bite plane designed by Jackson is the insertion in the plate of two small tubes on either side of the palatal surface so that a suitable framework, to which may be soldered clasps or any other desired attachment, may be firmly secured to the plate by means of wires which are passed through the small tubes and bent to one side, thus locking the framework to the plate. To any one who has had the experience of having a patient present with a clasp or other attachment broken from the plate, this removable feature will have a strong appeal, since all the metal portions can be readily removed from the plate by turning back the lock wires, thus releasing the entire framework from the plate and permitting of its easy replacement after repairs or changes have been made.

Looking through the appliance section in the Dental Index, one comes across innumerable reports of clinics or case treatments in which the bite plane in some form was demonstrated or employed. Grieve[15] demonstrated small metal bite planes attached to bands on the incisor teeth, which in his hands as well as in others who tried them proved very effective. Almost every one is familiar also with the small bite planes attached to molar bands which were used chiefly as retainers and perhaps also to assist in the correction of Class II cases.

Horace Howe reports a cast metal construction of the Hawley retainer. Others report swaged metal retainers and bite planes and have shown and illustrated their particular adaptations of either the fixed or the removable bite plane often referred to since Oliver's paper as the guide plane; and this use of it, by the way, may in one sense be regarded as the most modern method of employing the bite plane and yet is actually a return to the original principle given to the profession by Kingsley.

In 1929,[16] I showed and illustrated a fixed removable bite plane with a labial auxiliary wire, which I had found very useful in cases where the natural tendency of such a bite plane to drive the anterior teeth forward must be controlled, and this it does very effectively. This form of construction by grasping the teeth between the bite plane and the labial wire also may have the effect through the impact on the plate during mastication of depressing the maxillary incisors as well as the mandibular ones. This, of course, does not occur to an appreciable extent with a plate which covers a good part of the palatal surfaces. On the other hand, in cases where it is desirable to carry some or all of the anterior teeth forward, the labial wire is omitted or is not permitted to touch the labial surfaces of the anterior teeth. This tendency of some forms of the bite plane to move teeth forward can be used with great success in several ways. I have, during the last year or two, in cases needing a forward movement of one or more of the incisors, resorted to the use of a small coil spring inserted in a hole drilled into a vulcanite bite plane lingual to the tooth to be moved.

This produced a gentle and continuous forward pressure to which the teeth responded very satisfactorily. The labial wire can be relieved over these teeth but kept in contact with others which one does not wish to move, or they may all be moved forward if such movement is required. The lingual coil or spiral spring can also be used in conjunction with the labial wire for producing very satisfactory rotations which can afterwards be retained by the construction of a new Hawley retainer with or without bite plane or by simply putting in a post in place of the spring. If the size of the hole closely approximates that of the spring, a little hard wax or shellac will hold the spring firmly in place. Jackson accomplishes this by attaching a little spring with a safety pin coil in it to the removable framework which he uses, the other end projecting through a hole drilled through the plate at the point at which he wishes the end of the spring to press upon the tooth either to move it outward or to rotate it. No discussion of the bite plane should fail to take note of the well-known fact that

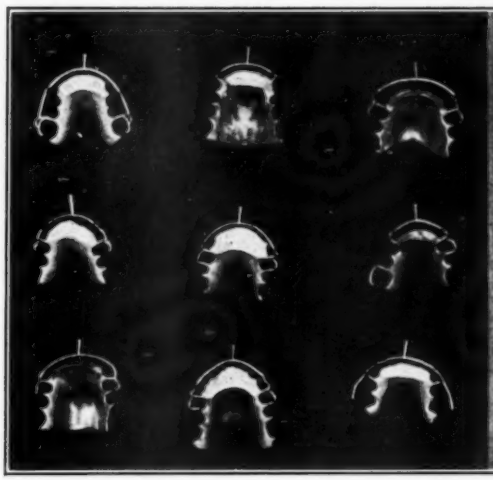

Fig. 1.

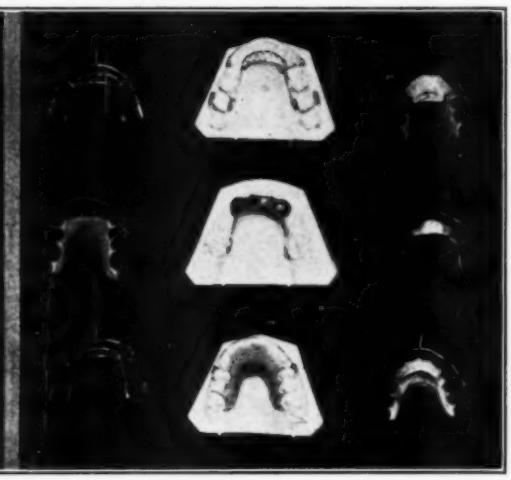

Fig. 2.

there are some deep overbite cases which may correct themselves or which may be corrected by means other than the bite plane. Almost any experienced orthodontist will remember Class II cases which were treated for the distal relationship without using a bite plane, which responded beautifully in the correction both of the distoclusion and the overbite. There is a mild tendency in all cases in which mesiodistal intermaxillary elastics are used for the bite to open, but it is only in those cases which yield very readily or might have changed spontaneously that we secure a result without the use of a bite plane or some other definite mechanical interference.

I referred in the beginning to a paper presented by Hopkins[17] at the meeting of the Southern Society of Orthodontists in Spartanburg, February, 1938, entitled, "Distoclusion Cases With and Without the Guide Plane," and I commend his analysis of the underlying principles of the bite plane and their application in modern orthodontic procedure to those interested in the subject as being much more comprehensive than could be injected into this brief sketch of its development.

I am also glad to have the opportunity of referring to what is actually the most recent contribution to the subject, since it was given only a month ago at the March meeting of the New York Society of Orthodontists. I refer to the paper by Samuel Hemley,[18] entitled, "Bite Plates, Their Application and Action," which is the report of what seems to me the most scientific research into the underlying principles of the bite plane or plate and its effects during treatment upon all the structures in the mouth and face directly or indirectly concerned that has yet appeared.

The accompanying illustrations will serve to clarify the descriptive text. Fig. 1 shows nine variations of the bite plane to meet requirements of individual cases. The metallic biting surfaces on some of them are most useful to avoid wear where the plane must be used for a considerable time. The form of clasp or attachment varies also to take advantage of the individual conditions. Fig. 2 shows other useful modifications of the bite plane. One of them is a filagree plane attached to a labial arch permitting use of the bite plane and intermaxillary elastics at the same time. Another shows hollow gold bite plane attached to lingual arch. Another has a biting surface very long mesiodistally, necessary in cases of extreme distoclusion. Two others show bite planes for the maxillary arch on models and another with an inclined bite plane for the mandibular arch attached to a lingual wire on a model and designed to aid in correcting a Class III malocclusion.

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FUNDAMENTAL FACTORS IN BODILY GROWTH AND THEIR RELATION TO THE ORTHODONTIC PROBLEM

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GROWTH happens to everything on the face of the earth, living or dead. It has been going on since the beginning of time, but strangely enough only in the last few years have scientists become interested in it and applied to the problems around us the observations which the study of growth makes possible.

Living cells have only one purpose, that is, to work. The activities of the cells while they work are known as the manifestations of life, and these are subject to the same immutable laws of physics, chemistry, and mathematics that govern the inanimate things which surround living cells.

It appears that living entities are exceptions to these laws. This is an illusion prompted by the fact that the effect of a natural law on an inanimate body is registered instantly; on the other hand, the effect on the animate cannot be immediately detected, and sometimes as long as one generation of the subject may be required to show the full workings of these laws. It is principally for this reason that many of the biological truths of today are fallacies tomorrow. Since the professions of dentistry and medicine deal in applied biology, it behooves the members not only to labor but also to wait before conclusions are drawn.

Manifestations of life are four: first, response to stimuli; second, reproduction; third, growth; fourth, metabolism. It is interesting as well as startling that only one of these four is the sole and exclusive attribute of living beings, namely, metabolism, for it will be found that inanimate things also grow, reproduce, and respond to stimuli, but only living things metabolize.

What is metabolism? It is the sum total of the enormous group of physical and chemical transformations which take place while a cell converts raw materials, known as food, into its own living protoplasm.

Since a cell must work it must also metabolize, and therefore must eat; therefore it is inevitable that a cell increases in size, but this can go only just so far, for immediately down upon it is clamped the first restriction, that mathematical law which states that a cell cannot occupy a surface area greater than its volume warrants.

F. T. Lewis[1] has demonstrated that the majority of cells are 14 sided geometrical patterns, which permit the largest volume to be held within the smallest surface, and as soon as this surface-to-volume ratio is disturbed, the cell must divide or be crushed. Of course, as it divides and forms two daughter cells, which gradually expand to the size of the parent, these increase the bulk of the organism, and that is "growth."

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Here is a most remarkable chain of events: To live is to work; to work is to eat and metabolize; to eat is to become larger; and to become larger precipitates growth. So growth is the inevitable sequel of function and metabolism. At this point I want to emphasize that growth does not depend upon function alone, but upon function and metabolism.

The natural question now is: Why do not cells keep on growing forever? The reason is that there is a conspiracy against anything going on forever on the face of the earth; and the conspirators which prevent cells from keeping on growing are three: first, autocatalysis; second, physiological demands; and, third, the pathological influence invoked by environment.

The phenomenon of autocatalysis can be detected by comparing the length of an animal against the time it takes for it to grow that size, and it will be found that the curve is almost identical with the purely chemical activity bearing that name, for in autocatalysis the agent which initiates the activity is the product of the chemical action itself, and as this goes on the agent increases in concentration, the activity accelerates, which in turn produces more of the agent and greater activity. And where does it stop? It stops exactly at the time and the place at which half the materials have been used, and then the whole process begins to diminish and finally halts, and almost the same thing happens in growth.

Physiological demands restrict growth in three ways: first, by function; second, by differentiation; third, by specialization, for the tissue which works the hardest or functions most, must eat the most and grow the fastest. Since the area of the organ of which it constitutes a part is already strictly limited, this hard working, fast growing tissue suppresses the growth of the less active ones.

Differentiation occurs when cells tire of just growing and, having no organization, so decide to get together and be affiliated with a certain organ, such as, liver, lung, bone, or skin; they cease to be just growing cells, and the moment they differentiate they sacrifice a considerable part of their reproductive capacity.

Like human beings, some cells are very ambitious; they get to be exceedingly highly skilled; and to them are assigned indispensable functions like nerve, kidney, or eye work. These cells can never reproduce, because nature will not dispense with their services, even for the brief period that it takes for them to have children.

Pathological influences are exerted by adverse environment, bacteria, and injury, which agents call forth protective and defensive mechanisms in the shape of phagocytes, increased acidity of tissue, disturbances of circulation, etc. The functioning cells must suspend their work and disease results, and if this keeps on too long, a permanent deformity is the result.

The things which restrict the growth of cells are not altogether responsible for limiting the growth of the body as a whole. It cannot grow indefinitely because of heredity, environment, climate, food supply, and habitat; and the most important of these is habitat.

Trees and plants do not have to move to defend themselves. A fish is supported almost entirely by water. Its mechanism for locomotion is purely

directive, hardly propulsive. Therefore, a fish also grows throughout life. But animals, insects, and birds, which live on earth, get around by means of legs and wings. A leg can support only as much weight as is proportionate to its cross section, and the larger the animal the bigger the leg must be, until finally the leg may get so big that it cannot be moved and the animal is literally rooted to the spot. It will be noticed through the geological evolution that the dinosaurs with very small legs, almost like fins, got on very well as long as there was plenty of water on the surface of the earth, but when the water dried up they fell prey to speedier enemies. In recent times, the Irish elk became extinct because, as this animal grew bigger and fatter, the antlers did the same, until finally they were so heavy as to prevent defense or the animal's running away. The most striking example of the influence of habitat on growth can be seen in the case of the two largest mammals on the face of the earth today, the elephant and the whale. The whale, being carried by water and needing no legs, grows and grows and grows; while the elephant, the largest terrestrial mammal, although smaller than the whale, must stop growing because his legs have gotten to the point where they almost are immovable.

As one thinks about the importance of legs, one is amazed at the astute observations of athletic trainers who notice that their champions last only as long as their legs. Undoubtedly, the instinctive appraisal of the fair sex by looking at their limbs probably dates back from the time when primitive man selected as his mate the one with the strongest, sturdiest, and most agile limbs.

I have been discussing what limits growth. A little time can now be spent in discussing why things grow as long as they do. One finds that is the result of several growth promoting substances: first, the internal secretions; second, tissue extracts; third, viruses; fourth, chemical compounds; fifth, vitamin B_1.

The endocrine or internal secretions are five: pituitary, thyroid, parathyroid, adrenal, and thymus. The most marvelous are those of the anterior lobe of the pituitary, which acts as the central switchboard of the whole endocrine organization, for within it are manufactured the messengers sent to the reproductive organs, the adrenals, and the thyroid, to tell these organs when and how much to work. Then, as though the pituitary had not enough to do, it takes on for itself a special growth promoting function which determines how large the skeleton may grow. Thus the circus giant is merely a youth who keeps on growing, and the lantern-jawed, large-handed, big-footed terror man of the movies is only a weakened acromegalic, whose pituitary has taken on again the production of growth hormones because of tumor development long after his growth had stopped.

The thyroid is essential to development. No mammal can differentiate from an infant to an adult without thyroid.

The parathyroid works hand in hand with the pituitary growth hormone by virtue of its role in the calcification of bone.

The effect of the adrenal glands probably is masked under the complexity of others, but as low as one one-millionth of a part of adrenal extract will stimulate remarkably the growth of the lower water animals.

The most interesting observation in recent years is that made by Rowntree,[2] who by injections of thymus extract was able to produce rats which had enormous teeth, and could be weaned in three days.

Tissue extracts need only be mentioned because they are the substances which stimulate repair after injury.

The growth promoting power of two viruses, Roos and Shope, has been the subject of study in the cancer problem because the first causes a chicken sarcoma and the second is responsible for rabbit warts, which may become malignant.

The chemicals are also important, because the hydrocarbons with high boiling points stimulate abnormal growth of the most vigorous cells, namely, cancer. There are certain pure chemical compounds, like indolacetic acid and pantothenic acid, which are indispensable for the growth of plants. The greatest growth stimulator of all, however, is vitamin B_1, without which no living thing, plant or animal, can grow.

Growth then is the harmonious interplay among seven factors:

1. The mathematical surface-to-volume ratio.
2. The chemical autocatalysis.
3. The physical restrictions of environments.
4. The influences of growth promoting substances.
5. The restriction by growth inhibiting agents.
6. Function.
7. Raw materials or food.

Function and food enable dental and medical clinicians to apply some of the knowledge of growth to the correction of deformity and the treatment of disease.

In recent years biologists have become reconciled to that heretofore insoluble problem: what is the determining factor in the development of the individual, heredity or environment, by acknowledging that heredity determines how far an organism can develop while environment determines whether it will ever get there. In my experience a human organism rarely ever achieves the limits established by heredity; and T. Wingate Todd,[3] probably one of the most celebrated anatomists of our time, says that the physical pattern of the individual is enhanced, warped, dwarfed, or mutilated in its expression by the effect of environment.

Hopkins,[4] the great British biochemist, states that nurture assists nature. As examples, one has only to mention the work of Mendel and Hubbell,[5] and Sherman and Campbell,[6] who have shown that by simple improvement of rations, an increase in the growth of animals occurs. Sherman[7] demonstrated that a simple alteration of just milk and grain ratios lengthened the life span of rats. Since what is true of the body as a whole applies to all its parts, the knowledge of the effects of good and bad nutrition upon growth places a very important weapon in the hands of the clinician.

The biological relationship between plants and animals is severed at the point where these two entities get their food; for the plant can utilize only the simple chemical elements, carbon, oxygen, nitrogen, phosphorus, sodium chloride, and others, and as its cells work they build them into the complex molecules of proteins, carbohydrates, fats, minerals and vitamins. The animal cannot do

that. It has to take these complex molecules, the proteins, carbohydrates, and fats, refine them and convert them into his own special brand. Thus the plant synthesizes foodstuffs for animals. The herbivora eat the plants and the carnivora eat the herbivora, and as this process of conversion takes place both species break down the complex molecules to simple compounds and elements, and finally the animals die. They also break down; bacteria then reduce the substances to still simpler materials to be returned to the plant in the form of carbon, nitrogen, sulfur, oxygen, chlorine, sodium, to be transformed again into products for animal consumption—an endless cycle.

Assuming that the importance of function is appreciated, the working knowledge of nutrition need concern dentists and physicians, in only four aspects: first, the quality and quantity of energy-producing foods; second, the quality and quantity of proteins; third, adequate supplies of calcium and phosphorus; fourth, adequate supplies of vitamins.

The energy of fuel-producing foods is a primary necessity to life because an organism, be it plant or animal, is, in its ultimate analysis, but a machine. It does not have, as might be supposed, automatic power-creating mechanisms, because that would be perpetual motion; and since, as it was first stated, biological organisms cannot run against natural laws, the energy required to run a body must be derived from sufficient fuel.

Whence does this come? The plant obtains it from the sun, and the animal by the combustion of food molecules with oxygen. But there is one exception to these methods, the greatest biological mystery of all time, the malignant tumor, which gets its energy neither from the sun nor from combustion, but by fermentation of starches in the presence of oxygen. Thus it obtains such a wealth of energy that that factor alone can explain the unlimited power to grow.

Therefore in applying additional facts to the handling of disease and deformity, provision must be made first of all for an abundant supply of energy-producing foods; namely, starches and sugars. A defficiency of this group will produce a skeleton that is of normal height but of narrow circumference. Cattle that do not have enough of these remain veal, and never develop into steers or cows. Dogs are dwarfed permanently.

Proteins are the building stones of growth and, in addition, for reasons as yet unknown, are as necessary for maintenance. The substances in proteins which are responsible for these effects are the amino acids. There are a large number of amino acids, but every dentist and physician should remember three without which no animal can grow or maintain its health: lysine, tryptophane, and histidine. Of these three, lysine apparently plays the part of health maintenance, for insufficiency causes the animal merely to stop growing, but without enough tryptophane or histidine it not only stops growing but loses weight and soon dies.

Where are these found? They occur in five foods, very easy to remember:

1. Milk.
2. Eggs.
3. Soy beans.
4. Brazil nuts.
5. Whole grains.

Calcium and phosphorus deserve the undivided attention of all. Calcium is the one substance that every animal must have in sufficient amounts. It does not make any difference what the race, color, creed, diet, or dietary habits are, the amount of calcium which is necessary to maintain health never varies. This fact alone should make one respect the importance of this mineral in maintaining health and vitality. The amazing thing is that in this country, with every facility for food production, with a number of impersonal scientific committees to certify the nutritional values of foodstuffs, the better classes have diets that contain the same degrees of calcium deficiency as those given to animals in studying the effects of lack of calcium.

An American child eats plenty of meat and eggs. This gives enough phosphorus, but the chemical law insists on one part of calcium and two parts of phosphorus. What happens then when the phosphorus ratio overbalances the already deficient calcium intake?

I have not forgotten about iron and copper, but in my opinion they are not very important, because if a diet contains sufficient calcium and phosphorus, an animal gets along quite satisfactorily, even though in time it becomes anemic.

Then come the vitamins. Every single vitamin is essential to growth, but the greatest number are not directly concerned with it, as they merely enable an animal to become strong and resistant enough against disease so as to go on growing. The function of maintaining well-being and resistance to illness is assigned to the vitamins A, G, and C. Mendel and Osborne[8, 9] and McCollum[10] have shown that with deficiency of vitamin A an animal becomes susceptible to infections and soon dies. Sherman[11] proved that in the absence of vitamin G an animal loses weight, and in a few months, dies. The amazing thing about vitamin G, however, is that its effect is mathematically proportionate to the amount given; that is, if an animal is given only half enough, it shows only half the benefits, especially the weight, and becomes normal only when it is given the full quantity. This influence, to me, is indeed most fascinating: to be able to reduce a biological effect which is almost in the domain of metaphysics to a phenomenon measurable in terms of mathematical units.

Vitamin C is necessary to good dentition and the best bone growth. This was shown by Zilva and Wells,[12] and although overemphasized, nevertheless there is abundant clinical evidence to prove that a sufficiency of vitamin C is essential to good dentition. If we back that up with the experiments of Walbach, Howe and Church,[13] who found that no healing could take place in the bone wounds of experimental animals in the face of inadequate vitamin C, and then to that we add the work of Rinehart,[14] who has treated successfully many cases of rheumatoid arthritides with vitamin C—and these are lesions of bone and connective tissue—there is plenty of evidence to show that in addition to the great number of duties which vitamin C performs as a respiration and oxidation-reduction potential, it also plays a part in the health of bone tissues.

Vitamin D is absolutely essential, because it is required to keep the adequate calcium-phosphorus ratio available. In rapidly growing children, the muscles, having more bulk and more activity, usurp all the available phosphorus and leave little or none for the bones. So, in face of this error in phosphorus metabolism, we get the worst type of rickets. But vitamin D prevents that, it is be-

lieved, by not permitting any of the calcium to be lost in the feces, and retaining in the circulating blood at all times the essential one part of calcium to two of phosphorus.

I have tried to bring out that science has now put into the hands of clinicians, dentists, and physicians two weapons: function and nutrition. By nutrition, growth can be inducted where there was none; by function, that growth can be directed to where it is needed.

It is fascinating to see how orthodontists have availed themselves of the first of these; by improving function they have utilized one of the most powerful growth stimulators. Now, with nutrition and the understanding of growth, perhaps certain cases may be attacked which have defeated the best efforts.

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CASE ANALYSIS FOR CLASSIFICATION

WILL MCLAIN THOMPSON, JR., PITTSBURGH, PA.

IT IS with a great deal of temerity that I approach the subject of case analysis for classification, but I feel that it is essential and deserves an important place in any approach to the orthodontic problem.

The present-day rationale in orthodontics seems to divide itself under the following headings.

1. Acquiring and recording in written form the case history.
2. Analysis of the case for the purpose of classification.
3. Determining the etiology from the case history and analysis.
4. Planning the treatment of the case, selecting the appliance to be used, and recording in proper sequence the tooth movement to be made and any myofunctional therapy that is indicated.
5. Retention of the case; checking it for the removal of all etiologic factors and the maintenance of the entire organ of mastication at its highest plane of efficiency, by occlusal coordination, for the life expectancy of the individual.

This presentation will be based on the Angle classification of malocclusion which was given to orthodontics by Dr. Angle in 1899.

Angle's classification, as originally presented, was based on the belief that the maxillary first permanent molars were stable landmarks in skull anatomy and thus safe points from which to determine deviations of the jaws. We now know that the maxillary first molars are not stable as landmarks; yet we do know that the maxillary first molars and canines are far more reliable as points from which to judge mesiodistal variations than any other teeth.

The Angle classification is probably the least complex, yet all inclusive, of any classification in use today.

The aims of a classification are manifold and among them are the following:

1. To reduce the large number of cases into small groups having common defects.
2. To aid in the treatment of cases by placing those which require similar treatment in the same groups.
3. It should give the orthodontist a means of expressing tooth and jaw malrelations which can be understood by his fellow practitioners and which will have a definite universal interpretation.

There are certain underlying principles to the Angle classification:

1. There is a normal mesiodistal relationship or anteroposterior relationship of the body of the mandible with its superimposed mandibular dental arch to the anatomy of the skull.
2. The maxillary dental arch, being built upon a base that is a fixed portion of the skull anatomy, is more or less stable in its relation to the various landmarks.

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3. If there is a shifting of the maxillary molars in their relationship to head anatomy, this variation can be detected by changes in the axial position of the teeth in the maxillary dental arch, especially the canine teeth.

Recapitulated in outline form, the Angle classification of malocclusion appears as follows:

Class I.—All cases of malocclusion in which the mandibular dental arch and the body of the mandible are in normal mesiodistal relationship to the anatomy of the skull.

Class II, Division 1.—Cases in which the mandibular dental arch and body of the mandible are in bilateral distal relationship to the anatomy of the skull and in which the maxillary incisor teeth manifest labial axial perversion.

Class II, Division 1, Subdivision.—Cases in which the mandibular dental arch and the body of the mandible are in unilateral distal relationship to the anatomy of skull and in which the maxillary incisors manifest labial axial perversion.

Class II, Division 2.—Cases in which the mandibular dental arch and the body of the mandible are in bilateral distal relationship to the anatomy of the skull and in which the maxillary central incisors show lingual axial perversion.

Class II, Division 2, Subdivision.—Cases in which the mandibular dental arch and the body of the mandible are in unilateral distal relationship to the anatomy of the skull and in which the maxillary central incisors are in lingual axial perversion.

Class III.—Cases in which the mandibular dental arch and the body of the mandible are in bilateral mesial relationship to the anatomy of the skull.

Class III, Subdivision.—Cases in which the mandibular dental arch and the body of the mandible are in unilateral mesial relationship to the anatomy of the skull.

The required material for a thorough case analysis consists first of a very careful examination of the patient; second, a complete case history; third, a set of plaster casts made from impressions taken either in plaster or in one of the hydrocolloidal impression materials (I do not believe that ordinary modeling compound is sufficiently accurate for this work); fourth, a full mouth set of dental roentgenograms; fifth, a full front view roentgenogram taken preferably in an instrument of the accuracy of the Broadbent roentgenographic cephalometer; sixth, lateral head plate roentgenograms showing the temporomandibular articulations; seventh, profile and front view photographs, preferably taken with the head oriented in a very definite and accurate position.

There are certain fundamental factors which must be considered before we may finally arrive at a correct classification of a case presenting with malocclusion:

1. The inclined plane relationship of the teeth with special reference to that of the maxillary first molars and the canines of each arch.

2. The axial inclination of the teeth, especially of the maxillary and mandibular canines.

3. The careful noting of missing teeth, either acquired or congenital, and the presence of supernumerary teeth, confirmed and disclosed by a conscientious study of the radiograms.

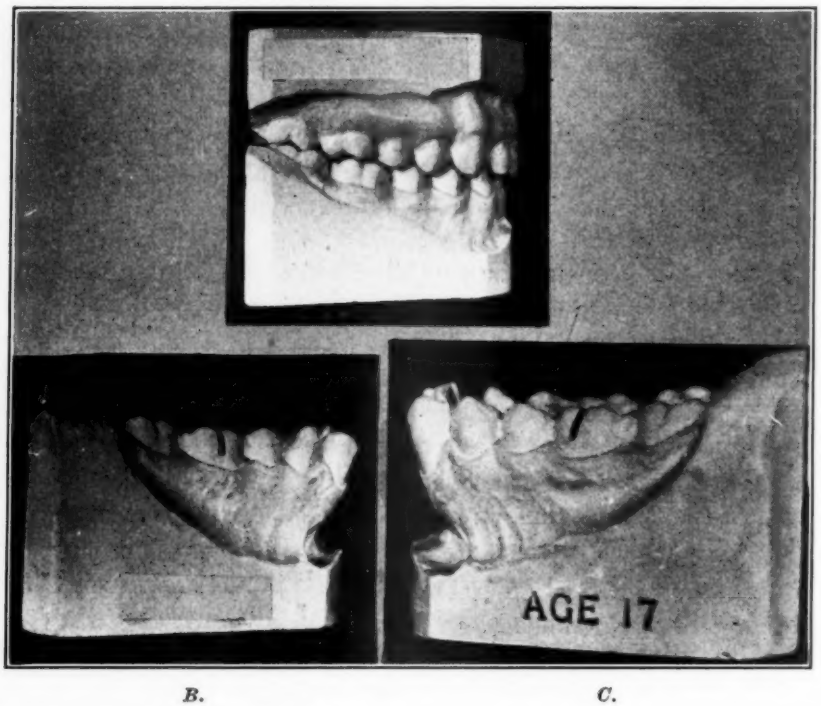
4. The rotation of molars, causing them to acquire more mesiodistal space than is their normal apportionment.

5. The relationship of the central proximal space in each arch with its opposing space in the opposite arch and with the median line of the facial anatomy.

6. A study of the facial photographs of the patient as an aid in determining the degree of growth of the mandible and its relationship to the anatomy of the skull.

Before we go into a detailed discussion of the above six factors, I want to give credit to a member of this Society, Dr. Robert Strang, for his splendid and clear manner of handling the problem of case analysis in his *Text Book of Orthodontia.* Much of this presentation will consist of almost direct quotations from his works.

A.



B. *C.*

Fig. 1.—*A*, Case showing normal axial inclination of teeth. *B* and *C*, case showing marked mesial axial inclination of canines.

Inclined Plane Relationship of the Teeth.—In analyzing a case of malocclusion in order to classify it, we must first examine the inclined plane relationship of the teeth. The maxillary and mandibular first molars are generally used as a starting point. If these inclined planes are normal, the evidence is favorable for a normal relationship of the mandibular dental arch and body of the mandible to skull anatomy, but this must be further verified.

Axial Inclination of Teeth, Especially the Canines.—Axial inclination refers to the relationship in the vertical plane that the tooth crown bears to its root. (Fig. 1.)

I was taught and still believe that the apical third of the canine root is the most stable landmark in denture anatomy. It is located in fairly dense bone; it is formed late in denture history; and environmental forces have not had enough time to disturb it.

Mutilated Cases and Those Complicated by Supernumerary Teeth.—The next step in the procedure of analysis takes into consideration mutilated cases, cases in which teeth are congenitally missing, and also those in which supernumerary teeth are present. (Fig. 2.)

In these cases we must reconstruct the arch area where teeth have been lost or are missing, and we must also make a thorough examination of the roentgenograms to determine just where this space is lacking.

Rotation of Molars.—The presence of badly rotated molars is usually evidence of strong abnormal muscular pressure and is often marked by excessive contraction of both dental arches.

Marked molar rotation is noted mostly in the maxillary first permanent molars and will cause them to occupy more dental arch space than is normal. Because of their taking more space than is normal, we sometimes find an im-

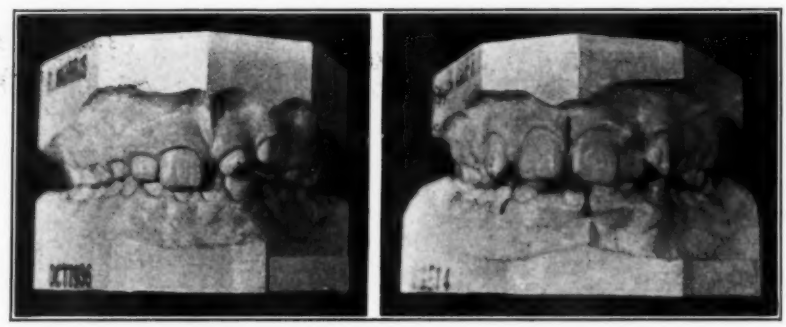


Fig. 2. Fig. 3.

Fig. 2.—Case presenting with a supernumerary central incisor. Note that this anomaly produced a unilateral disturbance in the occlusion.

Fig. 3.—Case presenting with inharmony between midcentral space in maxillary arch and that in mandibular arch.

proper relationship of the inclined planes, usually edge to edge, of the teeth anterior to the rotated molar.

We must mentally readjust this picture and place the rotated molars in their proper pivotal positions and readjust the inclined plane relationship before we can proceed with the analysis for classification.

Position and Relationship of the Median Line of Each Dental Arch.—A harmonious relationship of the central proximal space in each tooth arch with the opposing space in the opposite arch and with the median line of the facial anatomy when the jaws are closed in centric relation, is characteristic of normal occlusion.

If a harmonious relationship of these three median lines or planes does not exist, this is an indication that there is a malrelation either of individual teeth or of the dental arch as a unit. (Fig. 3.)

An examination of the patient as well as of the plaster models is absolutely necessary to determine where this lack of harmony is located. If the midcentral space of the mandibular dental arch is in harmony with the median plane of the

face but out of harmony with the midcentral space of the maxillary arch, then we are dealing with a shifting of teeth in the maxillary denture. If the midcentral space of the maxillary dental arch is in harmony with the median plane of the facial anatomy but not in harmony with the midcentral space of the mandibular dental arch, there are two possibilities: the teeth in the mandible have moved en masse through the bone, or one condyle has moved forward in search of a more comfortable relationship. The latter condition is usually accompanied by a very confusing condition which may lead to trouble if not carefully analyzed.

On the side toward which the mandibular median line has shifted we sometimes find the mandibular molars, premolars, and even the canines in buccal occlusion with the maxillary teeth, but their mesiodistal relationship will not have changed as a result of this condylar displacement.

On the side from which the condyle has moved forward, we find no change in the buccolingual relationship, but there may be a mesial relationship of the inclined planes of the mandibular teeth.

Fig. 4.—Patient exhibiting a true Class II, Division 1 malocclusion. Note distal relationship of body of mandible to skull anatomy, inclined plane relationship, and deep verticle overbite.

In the analysis of such a condition we must mentally replace the condyle where it belongs and then re-examine the inclined plane relationship.

Study of Photographs as Aid in Determining Degree of Growth of Mandible and Its Relation to Anatomy of the Skull.—The study of the photographs has been placed last because in teaching students to analyze cases they are so eager to examine the photographs and make a decision from them that they overlook other important factors.

Photographs can be very misleading, as has been pointed out by Scheffer and others. No definite standard technique has been worked out as yet which will give uniform results and still be practical for clinical use from the orthodontist's standpoint.

Let each of us examine our patients and note the facial lines more carefully and not rely so much on the photographs.

When we are examining the facial lines, let us be particularly interested in the relation of the mandible to the anatomy of the skull.

Let us see if the mandible is in its normal mesiodistal relation to the skull or if there is a lack of growth in the mandible in an anteroposterior direction. (Fig. 4.)

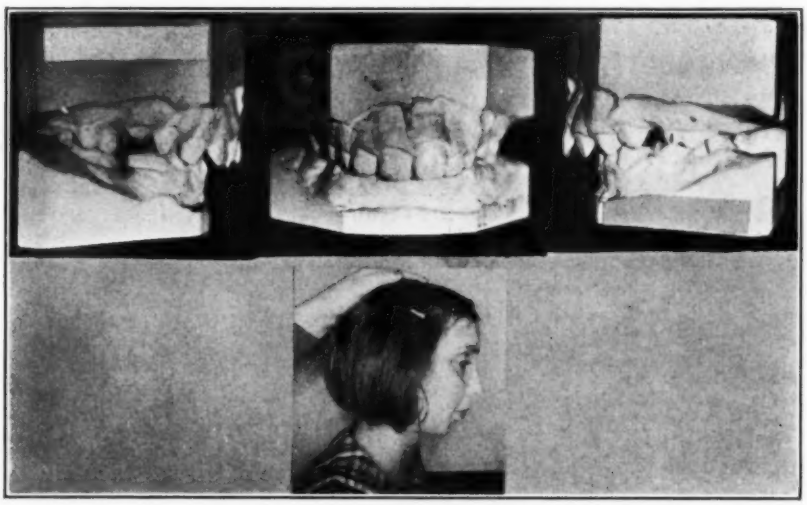


Fig. 5.—A true Class II, Division 2 case; note the lack of verticle development in the lower one-third of the face.

Fig. 6.—*A*, Very pronounced Class III case. *B*, Class III case complicated by the loss of mandibular first permanent molars.

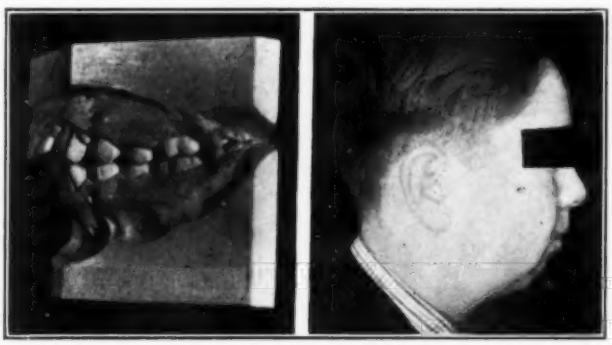


Fig. 7.—Mesial axial inclination of teeth in buccal segments, and profile of patient presenting a "sled runner" type of mandible.

Is the true position of the symphysis of the mandible masked by hypertrophied muscle tissue?

Does the patient present the so-called sled-runner type of mandible which apparently has no inherent growth force? Is there a marked lack of vertical development in the mandible, so characteristic of Class II, Division 2? (Fig. 5.)

In our examination of the patient's photographs and facial lines we must also look for an overgrowth of the mandible, particularly in the anteroposterior dimensions. Are the body of the mandible and its superimposed mandibular dental arch in mesial relationship to skull anatomy? (Fig. 6.)

The full front view photographs will often show a marked lack of symmetry even to the inexperienced operator, and all of this must be carefully noted before we can make our final statement as to the classification of the case.

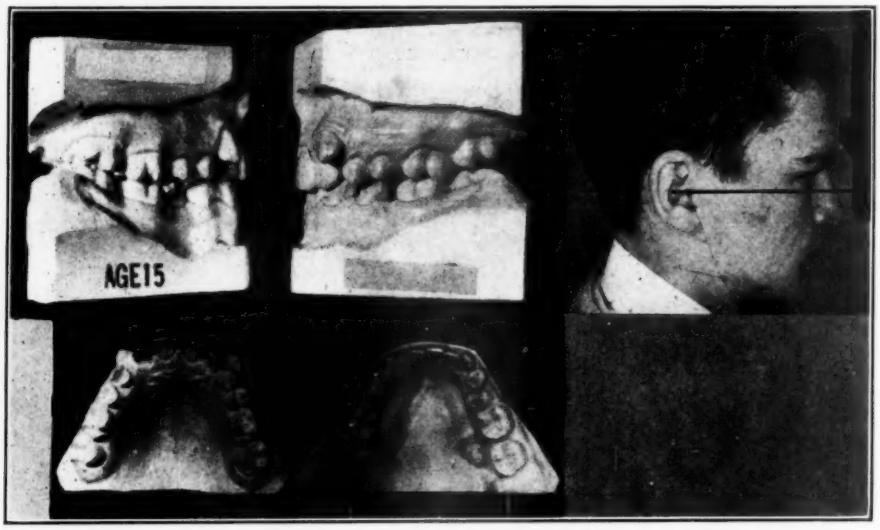


Fig. 8.—Class I case exhibiting marked mesial drift of the teeth in the maxillary buccal segments.

We must be always on the lookout for balance and harmony in facial lines and must do everything in our power to establish them if they are lacking or preserve the harmony of facial lines if present. (Figs. 7 and 8.)

No rules or formulae can be given that will govern or determine facial lines; this must be left to the judgment of the operator. It behooves us to train ourselves to a better appreciation of balance and harmony in art.

In closing let me say again that the analysis of a case of malocclusion for the purpose of classification is important and should not be made in a hasty, haphazard manner. If a case is not correctly classified, the chances are that it will not be properly treated.

We must be ever mindful that this is but one portion of the entire procedure but nevertheless an important one, and I have tried to relate the fundamental principles involved in an orderly system of analyzing a case of malocclusion to arrive at a correct classification.

WESTINGHOUSE BLDG.

MESIOCLUSION OF THE MAXILLARY TEETH

GEORGE M. ANDERSON, D.D.S., BALTIMORE, MD.

MECHANICAL principles applied in treatment of malocclusion of the teeth are rational enough, but the same cannot be said for our methods of diagnosis and classification. Time and again it has been proved to the specialist that identical technical plans and similar adjustment methods do not bring about comparable results in apparently the same types of malocclusion nor are completed cases maintained, no matter how hard we try. There is only one answer. We have been on the wrong track from the beginning. We had been trying to bring about an occlusal arrangement equally as contrary to the needs of the individual as that which already existed. No more fertile field in orthodontics exists for confusion in thought as to the type of abnormality than the so-called distoclusion cases. For years we have depended on Angle's classification as the backbone of our diagnostic endeavors, and in many instances satisfactory results have been obtained. I believe, however, in the light of present knowledge that luck played an important part. It created a false security. The relative positions of the maxillary and mandibular first molars may be satisfactory to each other but definitely displaced as to position in the jaw. The teeth may be a quarter inch forward of their "normal" positions, yet the mesiobuccal cusp of the maxillary first molar fits in the buccal groove of the mandibular first molar. Unless we are critical in our analysis, we are apt to classify this situation as Class I, neutroclusion. And so it is, as far as these *molars* are concerned and if the occlusal relations are to be the sole determinant. If, however, we consider the *denture* with the molars but a part, the case is not Class 1, neutroclusion, but a *mesioclusion of certain of the teeth.* It may be of the teeth in each arch, or of the teeth in one arch alone or in the maxilla only or in the mandible only. Grieve has been writing on this subject for a long time, and I believe that more and more practitioners are awakening to the fact that our classification is obsolete or most certainly confusing if used as a basis for the type of treatment to be adopted.

There is no question at all that much malocclusion has been treated only to relapse because of a faulty approach in the beginning whereby mesial movement of teeth was attempted when evidence available but unrecognized required that distal movement be the procedure.

There are very few distoclusions; in fact as I review the subject as it has occurred in my practice I now realize that they are actually a rarity, even the narrow arch type which we have always felt is a typical Class II, Division 1.

As we analyze the situation we realize that the stage is not set for a distoclusion, for the first permanent molars erupt without predecessors and therefore except for unusual reasons may be reasonably expected to occlude in good

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relation with each other and approximately in the region of the maxilla and mandible designated for them in nature's arrangement of the face.

Distoclusion is one of the most unfavorable types of malocclusion to treat, and the prognosis is unfavorable. That is because if we have a true distoclusion it is of very early origin and associated with obscure background such as inheritance, anatomical malrelation or maldevelopment. There may be a shortness of the body of the mandible or of the vertical portion, poor fossa arrangement or teeth actually too far distal on the body of a full formed mandible. We have paid too much attention to protruding or even retruding teeth, anterior teeth, when we should have been giving far more attention to the posterior teeth. I

Fig 1. Fig. 2.

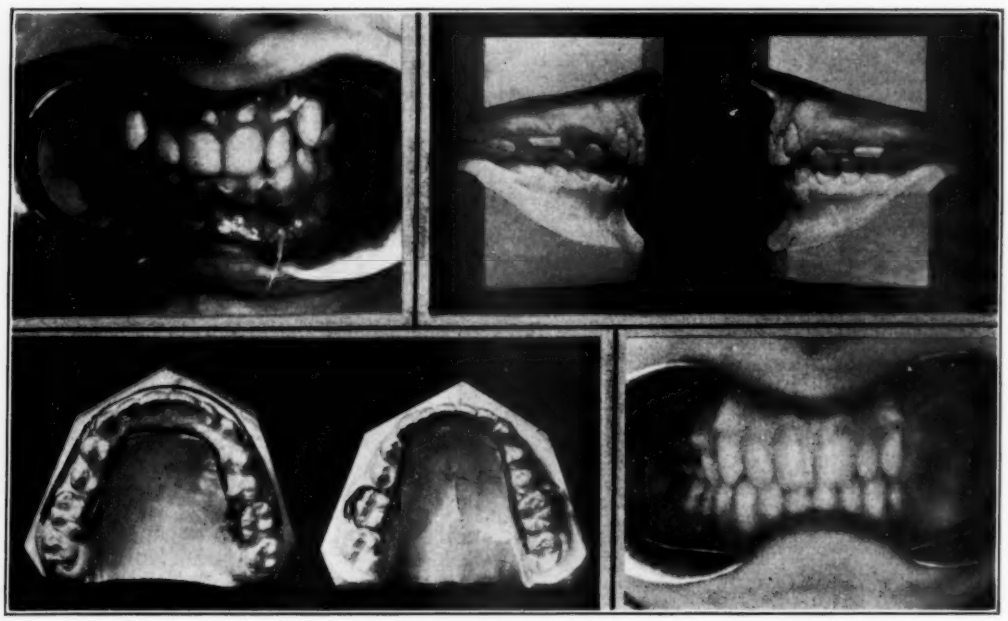

Fig. 3. Fig. 4.

reiterate that there is far more mesial occlusion of the teeth than distal occlusion and that in this problem lie many of the so-called failures of our corrective work.

I present a group of cases* which have had that fate in my hands and others which I feel are similar and which must be handled, if treated, by distal movement of the maxillary posterior teeth. The anterior malocclusion (incisor and canine) is dissimilar in all of them, but the posterior (molar) occlusion identical. That is, the *distobuccal* cusp of the maxillary first molar fits in the buccal groove of the mandibular first molar, giving the appearance of a Class II (Angle) or distoclusion. Treatment planned for the anterior malocclusion must, of course, be different for each case; yet the basic problem of treatment lies in the molar region, for there is the seat of the trouble in each instance. The situation is not at all unusual in an orthodontic practice and emphasizes

*Ten in all, but four are illustrated for publication.

the importance of furthering our classification studies so that treatment methods may evolve from a rational diagnosis.

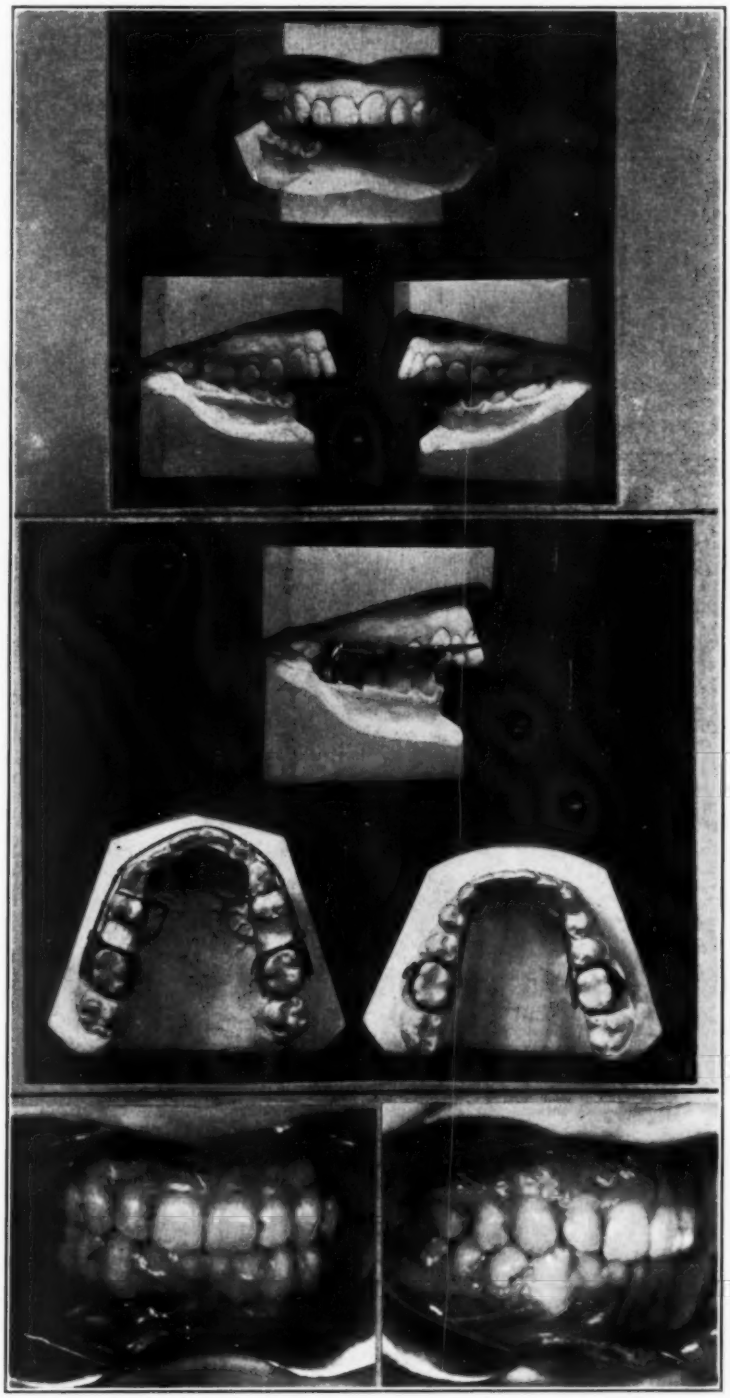

Fig. 5.

Fig. 6.

Fig. 7.

Case 1.—Labially erupted maxillary canines, incisors in good alignment (Fig. 1); mesial position of the maxillary posterior teeth (Fig. 2); facial appearance gave no evidence of distoclusion.

Diagnosis.—Bilateral mesioclusion of the maxillary posterior teeth.

Treatment.—Distal movement of the maxillary posterior teeth, no movement of incisors.

Fig. 8.

Fig. 9.

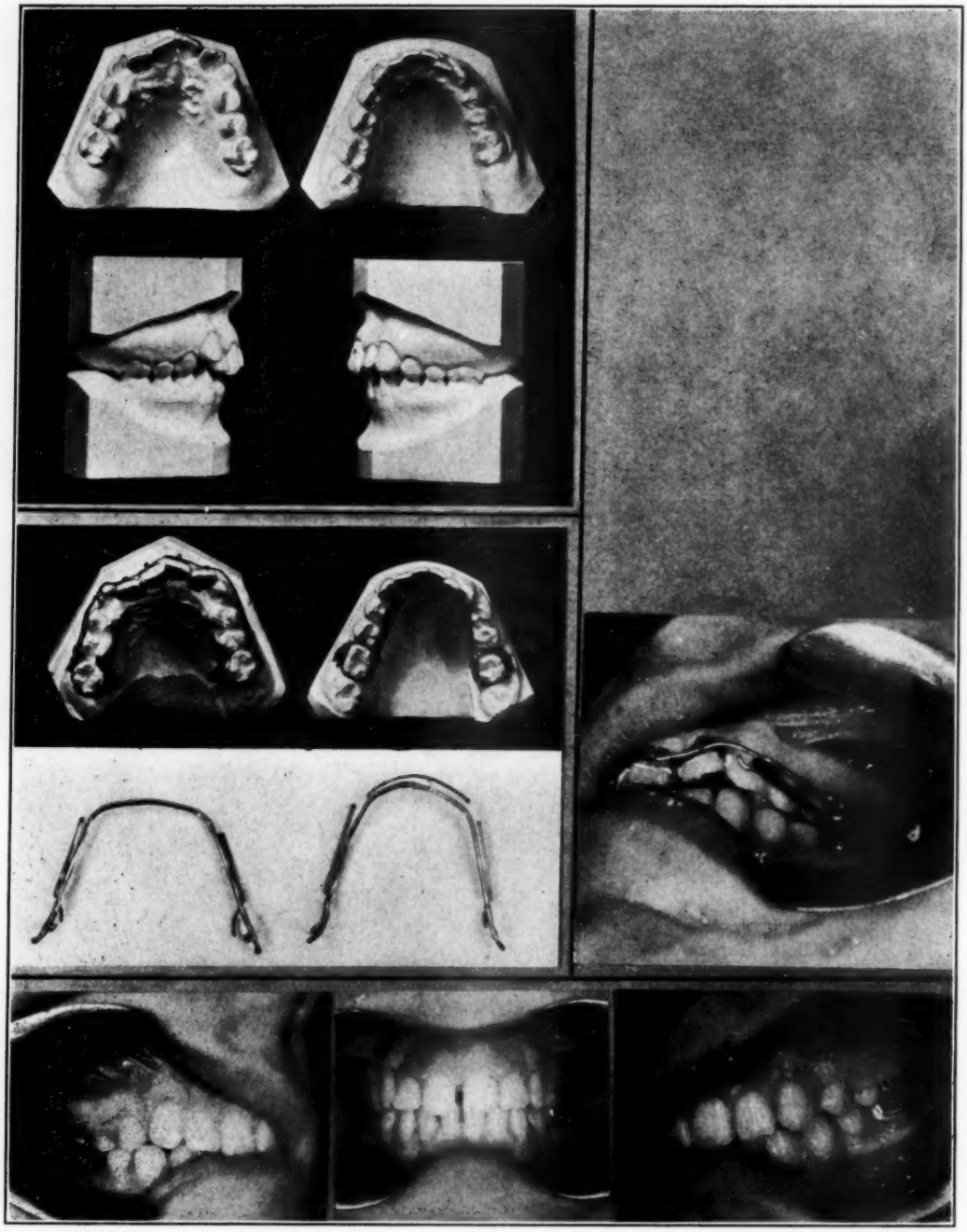

Fig. 10.

Fig. 11.

Appliances.—Mandibular lingual arch. Maxillary lingual and labial arch, intermaxillary elastics. (Fig. 3.) Labial arch kept free of incisors. Elastics were the motive power to move posterior teeth distally.

Result.—Cuspids in place (Fig. 4).

Case 2.—Protrusion of the maxillary arch. Typical Class II, Division 1 appearance (Fig. 5).

Diagnosis.—Bilateral mesioclusion of the maxillary arch.

Treatment.—Extraction of the second premolars and retraction of the anterior teeth. Bite to be opened.

Appliance.—Mandibular lingual arch. Maxillary lingual arch, labial arch to slide easily through the pull of the elastics (intermaxillary), lingual bite plate with loop springs to retract bicuspids (Fig. 6).

Result.—Good occlusion and alignment (Fig. 7).

Fig. 12. Fig. 13.

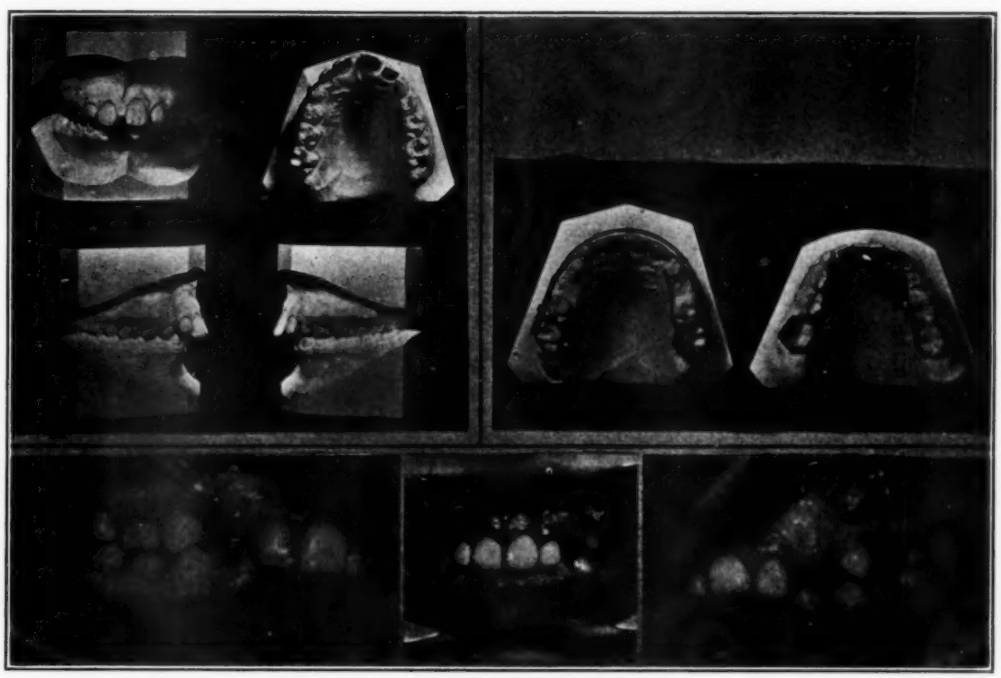

Fig. 14.

Case 3.—Crowded and rotated maxillary incisors, insufficient space for canines, mandibular arch form fair.

Diagnosis.—Collapse of the anterior segment of the maxillary arch but in addition mesial drifting of posterior teeth (Fig. 8).

Treatment.—Round out anterior teeth and carry posterior teeth distally, using intermaxillary elastics. No forward movement or as little as possible of the incisors.

Appliance.—Mandibular lingual arch with auxiliary springs, maxillary lingual arch with auxiliary springs, bracket bands on incisors, and ribbon labial arch with hooks and intermaxillary elastics (Figs. 9 and 10).

Result.—Incisors evenly aligned, molar teeth in good position (Fig. 11).

Case 4.—Class II, Division 1 subdivision (Fig. 12).

Diagnosis.—Unilateral mesioclusion of the left maxillary posterior teeth with protrusion of the maxillary anterior teeth. Left first molar half lingual.

Treatment.—Maxillary posterior teeth on left side carried distally with intermaxillary elastics, expansion left side, incisors to be tipped palatally and incisor spacing closed by moving these teeth further palatally.

Appliance.—Mandibular lingual arch, maxillary lingual extensions and labial arch, hooks for intermaxillary elastics (Fig. 13).

Results.—Molar relations good and incisors aligned and in vertical position (Fig. 14).

Department of Oral Surgery and Pathology

Edited by

STERLING V. MEAD AND KURT H. THOMA

Articles on oral surgery, radiography, and anesthesia should be submitted to Dr. Sterling V. Mead, 1149 Sixteenth Street Northwest, Washington, D. C. Articles on oral pathology should be submitted to Dr. Kurt H. Thoma, 47 Bay State Road, Boston, Mass.

METHODS OF IMMOBILIZATION OF THE FRACTURED MANDIBLE

RUSSELL L. RICHARDS,* B.S., D.D.S., LOS ANGELES, CALIF.

THE fractured mandible offers a unique problem to the dental or medical man, since a knowledge of occlusion of the teeth is of equal importance to a knowledge of orthopedics. The result is that the broken jaw has been placed in the unhappy hands of both professions. However, due to the fact that in hospitals large enough to support a dental department, that clinic, as such, routinely handles all the fractured jaws. Hence, the medical man trained in such a hospital has been accustomed to sending these cases to the dentist, and in private practice is only too glad to be able to refer the fractured mandible to a dentist capable of handling the situation.

The purpose of this article is to present the technique actually employed in the majority of cases of fracture of the mandible in the Los Angeles County General Hospital. Clinics have been offered in the past, which have always been on some spectacular case or unusual technique of immobilization. In each instance, stress has been placed on a theory of treatment or on an appliance which somebody offered for sale, or a mechanical oddity which had struck the fancy of the operator. Hence, the general practitioner has a hodgepodge of uncorrelated ideas on the management of the broken jaw, and it is our purpose to go back to simple, workable fundamentals. In short, we are offering an uncomplicated technique by which 80 to 85 per cent of all emergency fractured jaws can be handled in the hospital. I shall briefly describe the various splints and appliances generally used and attempt to place the emphasis on more important and simple methods of immobilizing the mandible.

A discussion of the fractured mandible should include: etiology, symptoms, diagnosis, reduction of the fracture, complications, physiology and histology of the callus and its eventual calcification, remarks as to the areas most frequently broken, a classification of the various types of breaks, management of patient, control of infection, etc. Because of lack of time, however, my remarks will be limited entirely to the immobilization of the fractured mandible.

The point to be emphasized is the superiority of simplicity over the more complex methods, in the immobilization of the fractured mandible. I have prepared on skulls most of the known methods of reducing fractures of the

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mandible, and I am going to let the appliances set forth their own merit. It should be pointed out that besides considering the mechanics of the appliance, the patient at best is in no condition to have any more done than is absolutely necessary. Even without any complications, other than the fracture, remember that the patient has had a bad experience and is apprehensive, that the jaw is painful, that anesthesia is difficult to obtain, that a tooth in the line of fracture may have to be removed, that there probably is considerable edema unless the patient has had immediate attention, and that there may be a great deal of manipulation during the reduction.

Also it should be emphasized that besides this picture of the fracture, there are, in most instances, complications of an appalling nature. A patient may be in shock or may be bleeding profusely, and usually is suffering from pain and is afraid of more pain. The patient frequently sustains other injuries about the head and neck, such as fractures of other bones, lacerations, contusion, and brain concussion with its stupor or its ravings, which mean that no general sedative or premedication can be administered. Also there may be present infection, tissue between the bone fragments, and wide separation of the fragments with tearing of the mucous membrane. In addition to this, a patient may be badly frightened by hospital or office technique, radiographic examination, and possible unsympathetic treatment by attendants: all of which occasionally reduces the neurasthenic patient to a state of nervous collapse, in which there is no ability to cooperate with the operator.

Bearing these usual fracture conditions in mind, I ask you to think of a technique for immobilization which would have: (1) ease of application; (2) ease of adjustment; (3) lack of bulk of apparatus; (4) simplicity of design and application; (5) sanitation; (6) sureness and accuracy of immobilization. I am going to outline briefly the appliances in their order of importance, placing emphasis on the simpler type, which will be shown last.

In the construction of any of the various splints, an accurate set of models must be made to articulate at least in centric position. The impression of the maxilla is easy to obtain, but the mandible offers a problem. In general, the mandibular impression is most easily obtained by making no attempt to reduce the fracture at the time of impression taking, which means that the model must be very carefully sawed at the approximate fracture lines and the parts of the mandibular cast reassembled in occlusion with the maxillary model. In certain very simple fractures, however, it is possible to reduce the fracture and hold the fragments in approximation while an impression is taken. It is obvious that if the entire procedure of impression taking, splint construction, fitting of the splint, and the delay and trauma of the operation could be avoided, it would lead to a more certain jaw reduction. But if a splint is indicated, then there is no choice.

EDENTULOUS CASES

When the fractured mandible is in an edentulous patient, there are only three generally recognized procedures to follow. In the simple fracture without great displacement, it is possible to wire the maxillary denture to the mandibular

denture, to form a perfect splint. Thus the fracture can be reduced and held in place by the splint and a four-tail bandage around the chin. In most fracture cases, however, the dentures are broken or lost, or the displacement is too great, and another method of immobilizing the mandible must be found.

This leaves only two courses open: One is to perform an open reduction, and the other is to do a circumferential wiring on a splint. Oviously, an open reduction is to be avoided if a good reduction and immobilization can be effected by any means not quite so extensive.

If the fracture is in the body of the mandible, it is possible to make a vulcanite splint like a saddle, to cover the alveolar ridge crossing the line of fracture, and to hold this splint in place by wiring over the splint and around the inferior border of the mandible. This wiring can be done through small incisions, under a local anesthesia, with the aid of a trocar so that a good immobilization can be effected. The circumferential wires are surprisingly well tolerated by the soft tissues surrounding the mandible and may be retained for several weeks. This method is used to better advantage for fractures of the body of the mandible not involving the angle.

If the fracture is posterior to the alveolar ridge, so that no splint can be applied and the patient's general condition will permit, then an open operation must be performed. Obviously, the open reduction should be done by the oral surgeon; the description of the technique of the surgery will not be described here.

KINGSLEY SPLINT

In the construction of the Kingsley splint, one of these two impression techniques is employed, and models are articulated in centric position. A wax pattern is designed and invested, using the common vulcanite technique. Then the sheath of the Kingsley arm is embedded in the rubber, and the case is vulcanized and polished as quickly as possible. The fracture is reduced again, and the appliance is placed in the patient's mouth and held by pressure bandages under the chin.

The disadvantages are:

1. The inaccuracy of the reduction and immobilization.
2. The trauma of impression technique.
3. The necessity of a double reduction.
4. The loss of time required by the construction of the splint.
5. The need for extraoral bandages or appliances.
6. The general discomfort of the appliance.

The advantages are:

1. The mouth can be opened for feeding.
2. If it should become necessary to remove the appliance during the period of immobilization, it can be easily accomplished by removing the pressure bandage; then a mandible can again be easily immobilized by replacing the appliance with the bandage.

The modern Kingsley splint is used to more advantage on the maxillary fracture than on the mandibular fracture, since the arms can be designed to give the right direction of stress when rubber bands or bandages are applied to a plaster head and shoulder cast.

GUNNING SPLINT

Dr. Gunning, a dentist in New York City, was called to treat the fractured mandible of Secretary of State Seward, on the night of the assassination of President Lincoln. Because of the prominence of the patient, the appliance became known as the Gunning splint. An impression is taken, and casts are poured; then the case is cut at the approximate fracture lines, and the teeth are arranged to occlusion. The models are placed on an articulator, and the splint is designed and made as quickly as possible. The fracture is reduced and the appliance placed in the mouth and the mandible held in the appliance by the four-tail Barton bandage around the head and under the chin.

The faults of the splint are:

1. The inaccuracy of the cutting of the fracture lines and the resulting inaccuracy of the reduction and immobilization.
2. The bulk of the apparatus.
3. The loss of time required by the construction of the splint.
4. The handling of tissues during impression taking, and obvious increase in trauma.
5. The chance of infection resulting from unsterilizable materials and loss of time from the fracture to the final immobilization.
6. The dryness of mouth because of its being held slightly open for six weeks.

The advantage of the appliance is that the mouth is open for feeding.

ANGLE'S FRACTURE BANDS

Angle's patented fracture bands are orthodontic bands with little knobs soldered on so that the knobs extend laterally from the teeth. These bands are adjusted to the teeth and are held by the usual orthodontic screw attachment, with the knob extending from the labial or buccal surface of the tooth. The fracture is reduced, and around the knobs are placed either wires or rubber bands, and an intermaxillary wiring is effected.

The disadvantages of this method of fracture treatment are:

1. The difficulty in adjustment of the bands by the average dentist, even though this may be a simple procedure to the orthodontist.
2. The bulk of the apparatus.
3. The lack of sanitation.

The advantages are:

1. The firmness and the sureness of attachment to the teeth.
2. The ease of application of desired stress in opposition to muscle pull of the bone fragments.
3. The ease with which the mouth can be opened and again immobilized with the intermaxillary wires or rubber bands.

LABIAL ARCH BANDS

In 1887, Dr. Thomas L. Gilmer first used the silver labial arch wire from which the modern arch band was devised, and for some reason this band seems to be used today, mostly by the navy dentists. The arch bands are contoured directly in the mouth and are wired separately to the respective arches. The fracture is reduced and the mouth is closed by intermaxillary rubber bands or wires.

The disadvantages are:

1. The time consumed and the difficulty in contouring the arch bands.
2. Lack of sanitation. The fracture reduced by this method is very difficult to keep clean; this results in the average case being filthy during the period of immobilization.
3. The bulk and discomfort of the appliance against the cheeks.

The advantages are:

1. The ease of application of stress against the muscle pull on the bone fragments.
2. The mouth can be opened easily, if necessary, by severing the intermaxillary wires or bands.

RUBBER BANDS WITH LEAD SHOT OR BUTTONS

The lead shot and the patented button have a hole through which the interdental wire loop can be applied to hold the shot or button close to the neck of the tooth. This method has a distinct use in those cases which cannot be manipulated to a good reduction, and which need an ever present physiologic force to pull the bone fragments gradually into closer apposition as the swelling subsides. The fracture is reduced, and the mandibular teeth are brought into occlusion with the maxillary teeth and held there by intermaxillary rubber bands attached to the shot or rubber.

The disadvantages of this technique are:

1. The lack of stability of the immobilization due to the intermaxillary rubber band.
2. The possibility of too great stress upon any two teeth because of the uneven and uncontrollable pull of the rubber band.
3. The bulk of the apparatus in the patient's mouth.
4. The lack of sanitation.
5. The need of special patented appliances.

The advantages offered by this technique are:

1. The steady pull of the elastic band to a bone fragment not quite in position because of edema.
2. The ease with which the mouth can be opened if necessary and again easily closed by attaching the new rubber bands.

SIMPLE INTERMAXILLARY WIRING

Intermaxillary wiring is the easiest, the simplest, and the preferred method of immobilizing the fractured mandible. This method can be done in one of several different ways, each of which presents some advantages peculiar to the case in consideration.

The first of these, the crossed wire method, might be more advantageous in certain cases. It originally was used where the fracture line was between two teeth, and the crossed wires tended to pull the bone fragments closer together in addition to gaining the help of the normal lock of the cusps of the teeth. Some operators cross all wires around the arch, which offers no advantages; in fact the crossed wires seem to add to the lack of mouth cleanliness.

The second common intermaxillary wiring method has the looped interdental wire around the neck of the teeth to which is attached a separate intermaxillary wire. One advantage of this type of wiring is that the mouth can be easily opened, if necessary, by simply cutting the intermaxillary wires. Its main advantage, however, is that as the intermaxillary wire is tightened, it automatically tightens the interdental wire around the necks of the two teeth enclosed by that wire. Thus, as the wires stretch and are tightened during the several weeks of treatment, the interdental wire is always tight and snug around the necks of the teeth.

The third and most commonly used method is the simple intermaxillary wiring of the teeth. A usual case might have wires around the necks of the bicuspids and the first and second molars on both sides, above and below, which are twisted with the wires from the opposing and corresponding teeth of the opposite arch. Thus, there are only six or eight intermaxillary wires to tighten and adjust as the calcification is taking place; and, if all wires are routinely turned clockwise, there will never be any error.

This method offers some advantages which cannot be overlooked:

1. The lack of a large armamentarium and patented appliances, because all that is needed is fracture wire, hemostats, pliers, and wire cutters.
2. Ease of application.
3. Ease of adjustment, since all that need be done is to keep the intermaxillary wires tight.
4. The mouth can be kept fairly clean by the toothbrush and oxidizing mouthwashes.
5. Lack of bulk of apparatus in the patient's mouth; by turning the ends of the wires into the interproximal spaces, the patient does not notice the appliance.

6. Most important are the sureness and the accuracy of the immobilization. Once the fracture is reduced and the mandibular teeth are closed tightly against the maxillary teeth, then the lock of the cusps and the stress of wires rarely allow the bone fragments to move. To me, this is the quickest and the most logical method to use in the majority of cases.

Obviously, there can be no standardized technique for immobilization of jaw fractures, and I do not mean to infer that the simple intermaxillary wiring is best suited for all cases. In the vast majority of fractures, however, it can be used to more advantage than any other more complicated method. Of all the fractures treated at the Los Angeles County Hospital in the past five years, at least 85 per cent were handled in this manner. It is significant that the more experienced the oral surgeon, the more he tends to the simpler type of fracture appliances.

PROCAINE IN LOCAL ANESTHESIA*

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PROCAINE produces anesthesia by absorption of the anesthetic base by the lipoid substances of the nerve and tissue cells, thereby preventing these cells from normal function or metabolism. How this base is presented to the tissue, the difference in the rate of anesthesia, the depth and length of time of the anesthesia, together with the occasional undesirable symptoms that may occur and the indications and contraindications for its use, will be discussed. It is presumed that the discussion to follow will bring out further details that now confuse the operator. Our discussion will be based upon the theory that the reader is familiar with injections used in the dental field, that he has had unfavorable reactions and would like to avoid such reactions in the future insofar as possible.

We should regard procaine solutions as physiologic or biologic solutions which, when present in the areas subjected to their influence, conform to normal tissue (cell) environment as far as possible.

Ninety per cent of dental operations require only a short anesthesia of one-half to three-quarters of an hour. To return the tissues to normal as soon as possible is desirable. At the outset, let us consider the requirements of an ideal local anesthetic.

1. The technique should be simple and safe.
2. The solution should have a pH of 7.4 and be isotonic.
3. It should produce a speedy and profound anesthesia.
4. It should not cause hemolysis of the red blood cells.
5. It should not cause rupture of tissue cells.
6. It should not cause rupture of fat cells.
7. It should not cause local necrosis.
8. It should not cause inflammation.
9. It should not cause a local acidosis.
10. It should not cause a systemic reaction.
11. It should not cause edema.
12. It should be stable over a reasonable period.
13. It should have vasoconstricting properties in itself.
14. It should be nontoxic.
15. After a reasonable time there should be a return to normal, free of postinjection pain caused from failure of the foregoing requirements.

Let us now discuss these requirements in relation to the procaine solutions that are available to the profession. Three types of solutions are available:

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acid, neutral, and alkaline. We shall deal with two only, the so-called acid and alkaline solutions. With either solution the first requirement can be satisfied, as the technique is simple and safe.

The second requirement is that the solution shall have a pH of 7.4 and be isotonic. Any procaine solution must be reduced to an alkaline state before anesthesia develops.[1] Fig. 1 gives the relative pH values of the blood and tissues as well as of the procaine solutions.

You will observe that arterial blood has a pH of 7.4 and that venous blood has a pH of 7.38 due to carbon dioxide content; while procaine chloride has a

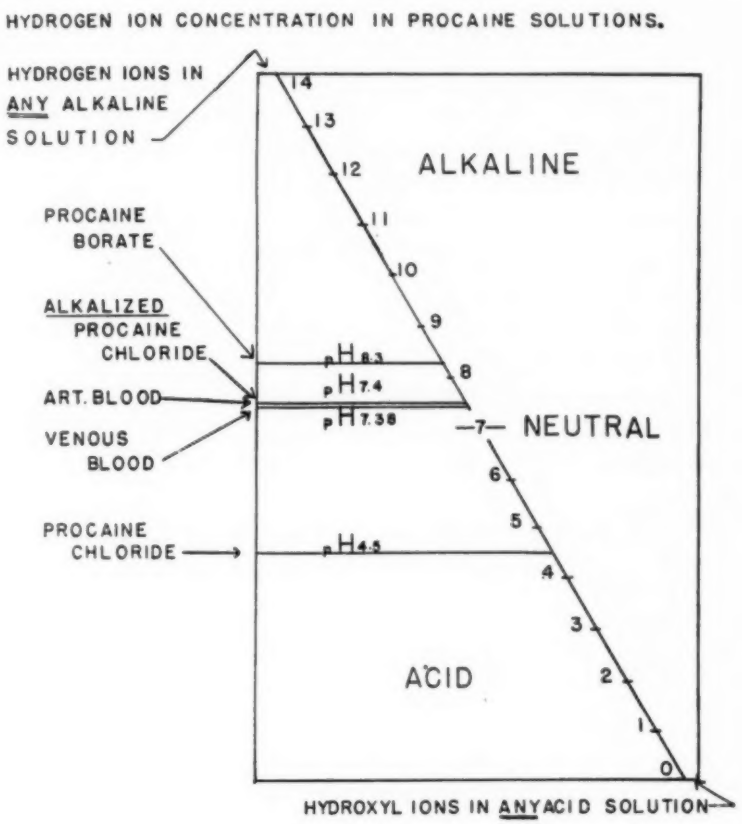

Fig. 1.

pH value of 4.5, and procaine borate has a pH value of 8.3. Alkalized procaine chloride, on the other hand, has a pH value of 7.4.

Some of these values represent great acidity when compared to tissue; for example, the procaine chloride is about 1000 times more acid than tissue. The procaine borate represents an alkalinity of 10, whereas the commercially available alkalized procaine is about the same as tissue (7.4). Clinically it will be observed that the more acid the solution, the slower the anesthesia; the more alkaline the solution up to 8.6, the faster the anesthesia. By the freezing method of determining the isotonicity of solutions it has been found that there is isotonicity with procaine borate and alkalized procaine. This comparison is correct within experimental limits.

The third requirement is that the local anesthetic shall produce a speedy and profound anesthesia. The advantage is decidedly in favor of the natural alkaline salt (procaine borate) and alkalized procaine chloride. Before any anesthesia develops with any procaine solution, it must become alkaline in order that the anesthetic base be liberated. The anesthetic base will not be free to be absorbed so long as the solution remains in an acid state. When the base is liberated, it is absorbed by the lipoid structures of the nerve cells. Anesthesia then follows, its profoundness dependent upon the amount of the base absorbed plus vasoconstriction. With the natural alkaline salt, the borate, and the alkalized procaine, the free base is presented to the cells immediately upon injection. Consequently, if the injection is made at the proper rate of 1 c.c. per minute, symptoms of anesthesia will be produced before the needle is withdrawn. Alkaline solutions require an accurate technique. Too rapid injection of alkaline solution may produce as unfavorable a reaction as acid solution. This point cannot be stressed too strongly. The resulting hydraulic blunt dissection of rapid injection is very important also, as far as postinjection pain is concerned.

As to the amount of base in the various salts: the chloride has about twice the amount of the borate. Alkalinization of the chloride does not change the amount of base. If the procaine borate salt is used and the same amount of procaine base is desired as is found in the hydrochloride, it would be necessary to use a 4 per cent solution of the borate to give the equivalent amount of base found in the 2 per cent procaine hydrochloride.

It has been shown that alkalinity determines the rate of anesthesia,[1] while epinephrine influences the rate of vascular absorption. Toxicity is independent of either; as a matter of fact, epinephrine reduces possible procaine toxicity by retarding vascular absorption. It must be borne in mind that there is only one way in which systemic effects can be produced rapidly and that is by intravenous injection. To prevent this occurrence one should use a glass barreled syringe so constructed that the plunger can be withdrawn to observe blood, when a vein is punctured. A to-and-fro motion while injecting with other types of syringes is helpful but not infallible in preventing an injection into a blood vessel.

Cell destruction occurs to a small degree with any local anesthetic solution, but is very marked with acid solutions. It has been found by both experimental and clinical observation that an acidosis exists in any inflammatory process. The nearer we approach the central focus the greater the acidity, which in some cases may be as high as 5.6 pH accompanied with necrosis. Consequently acid solutions when injected with a vasoconstrictor of prolonged activity produce an inflammatory process (local acidosis) with postoperative complications.

The alkaline solution has no such effect and therefore cannot produce such a process unless one injects a solution with a pH above 8.9 (pH above 8.9 produces alkalosis). The alkalized procaine hydrochloride produces no local complication; it actually assists tissue to recover.

Von Gaza and Brandi[2] demonstrated in a series of 1000 cases that an alkaline solution with a pH of 8 to 9.1 could be injected into an area of cellulitis with resultant improvement of the inflammation.[3] In these experiments they used an alkaline solution with a pH value of 9.1. Although this procedure is

not advocated for clinical purposes, it demonstrates the value of alkaline local anesthetic solutions and their acceptability to tissue.

SYSTEMIC REACTIONS

Systemic reaction coincident with the use of local procaine anesthesia is a large field with many ramifications up to and including psychic trauma. Procaine is toxic. Reaction from toxicity is immediate and is enhanced by accidental venous injection. That there is a definite dosage for any toxic substance is questionable. The individual determines toxicity.

Procaine is a vasodilator. As such it can cause symptoms of distress more easily than if combined with some vasoconstrictor to prevent too rapid absorption of the base. A vasoconstrictor is added to solutions of procaine, first, to retard absorption of procaine, and second to produce longer anesthesia by reducing circulation. These vasoconstrictors in themselves are more or less toxic, but systemic reaction is dependent again upon whether or not an accidental venous injection is made.

Six factors enter into symptoms of distress:

1. Administration of an overdose for an individual patient.
2. Susceptibility of the patient.
3. Toxicity of the anesthetics.
4. Restricted respiration.
5. Cardiac and renal complications.
6. Idiosynerasy, if it is present.

Toxicity from an overdose varies with the individual and the method of administration. All symptoms are not dependent on the anesthetic or the amount administered, but toxicity depends upon the rate of absorption and the rate of injection. A safe rule seems to be that the amount is dependent upon the physical condition of the patient. All factors enter into the situation and should be carefully analyzed.

The value of a sedative to avoid unpleasant symptoms cannot be overestimated. It lessens the sensation of the needle, gives a more profound anesthesia with a smaller amount of solution, and fear and apprehension are reduced so that the patient remains calm and cooperative.

TABLE I

SYMPTOMS	CAUSES
1. Pulse rate increased	1. Fear and emotion 2. Toxicity of drug 3. Toxicity of vasoconstrictor
2. Blood pressure increased	1. Fear and emotion 2. Vasoconstrictor of solution 3. Too rapid injection
3. Peculiar sensation in limbs and body	1. Fear and emotion 2. Effect epinephrine has on blood pressure
4. Dyspnea	1. Lack of oxygenation of blood
5. Cold, clammy perspiration	1. Toxic action of drugs either alone or combined
6. Shock	1. Psychic disturbances 2. Surgical manipulation
7. Toxicity	1. The anesthetic or vasoconstrictor

Fear and strong emotional excitement cause a production of epinephrine or adrenalin in the body with a resultant increase in concentration in the blood and increased heart action, later followed by stimulation of the vagus nerve with attendant cardiac depression and splanchnic dilatation.

Often such symptoms are attributed to procaine itself; whereas the underlying factor of emotional excitement and its sequelae are responsible. Table I relates causes to symptoms.

PSYCHIC SHOCK

Psychic shock is of two types: (1) depressive, and (2) excitant. Since the clinical symptoms of psychic shock and the toxic manifestations of procaine and epinephrine are very similar and easily confused, it is deemed wise to review this subject in the following paragraphs.

In the depressive type of shock the patient is quiet, conscious, will answer questions; his eyes may be open or partially closed, there is some impairment of speech, apathy, considerable muscular relaxation, and a ghastly expression. The pupils may be dilated, the pulse slowed, and the respiration shallow and irregular. Blood pressure will drop, the patient will complain of being cold and sometimes dizzy, the hands are clammy. If a still deeper stage is reached, the sphincter ani may relax. Shock may be very light, such as fainting, or it may be intense and terminate in death through respiratory and cardiac failure. In pronounced shock the patient is oblivious to pain.

The second form, characterized by increasing excitement, is rare. The pulse is very rapid, talk is incoherent, movement is uncontrolled. This is followed by a rapid drop in blood pressure, collapse, and death.

REACTIONS TO LOCAL ANESTHESIA

Systemic reactions to local anesthesia (procaine and epinephrine) may be similarly grouped into two types: the stimulant and the depressive. Epinephrine toxicity or reaction produces the following symptoms, which are of the stimulant type: tremor of extremities and abdomen, heart palpitation, general weakness, labored respiration, rapid pulse, pallor extending over the face, abdominal relaxation, emotional instability, and syncope or fainting. These effects occur rapidly and subside rapidly, and are rarely serious. Slow injection of the solution should help to prevent them. This type of reaction is best controlled by giving a preoperative sedative, such as barbital 5 gr.; luminal 1½ gr.; seconal ¾ gr. The toxic effect of epinephrine is manifested by an alteration of the vasomotor mechanism with stimulation of the brain centers causing tremors, restlessness, and increase in respirations. The stimulation of the sympathetic nervous system causes a rise in blood pressure, an increase in pulse rate, abdominal relaxation with dilatation of the splanchnic vessels, and fainting due to cerebral anemia. Procaine toxicity, on the other hand, is slower in onset but will be of the depressant type and, if serious, respiratory failure will occur. The patient will be quiet, the pupils may be dilated, the pulse will be slowed, respirations will be shallow and irregular, blood pressure will drop; the patient will complain of being cold and perhaps dizzy, the hands will be cold and clammy, nausea may follow, or vomiting may occur, with convulsions,

coma, and respiratory failure. It is rare, however, that the small amounts of 2 per cent procaine solution used routinely will cause such a reaction, except in marked idiosyncrasy.

MEDICATION

In employing local anesthesia with procaine, one should watch for either the stimulant type reaction or the depressant and use appropriate symptomatic measures. We have spoken of the use of sedatives preoperatively to depress the midbrain in the stimulant type of reaction. In the depressant reaction, if the heart action becomes too weak, coramine (1 ampoule) administered hypodermically may be used. A few drops of ether on a sponge for inhalation may be used also in an emergency for cardiac stimulation in the event that other means are not at hand. As a respiratory stimulant sodium benzoate and caffeine 7½ gr. are given hypodermically, or advantage may be taken of the respiratory stimulation of coramine.

Circulatory depression is combated by the injection of either 3 to 5 minims of 1:1000 epinephrine repeated in five to ten minutes, or ⅙ gr. neosynephrine. Neosynephrine will increase and maintain blood pressure for more than an hour, in ⅙ gr. dosage given intramuscularly, or for several hours if given by mouth in 3 to 5 gr. dosage.[4]

TECHNICAL CONSIDERATIONS

It is very difficult to carry out Crile's exact teaching in dental operations. Nevertheless a great deal can be done. First of all manipulation of soft tissue about the mouth causes little nervous shock to the central nervous system. Confidence of the patient plus a good anesthesia helps greatly. By no means begin any operation before anesthesia is complete. Psychic trauma can be caused by prolonged operation which results from failure of the local anesthetic, as well as the length of operating time. Burring or chiseling of bone and other procedures must be done very carefully, and speed has no place if it results in tissues being injured badly. Vital powers are at their height early in the morning, and should we have difficult operations, to perform, we advise to try and perform them at an early hour.

No local anesthetic can be absolutely nontoxic. While all procaine solutions are stable when freshly prepared, they all are subject to oxidation. The anesthetic base is most active at the moment of its preparation, and for that reason alone a fresh solution is preferable. Anesthesia is produced, however, with stale solutions more often than not.

As regards the requirement that the ideal local anesthetic have vasoconstricting properties in itself, it may be said that at the present time only two local anesthetics have that property; namely, cocaine hydrochloride and monocaine. Cocaine hydrochloride for any submucous injection has been condemned by the American Medical Association. Monocaine, closely related to procaine but with a different molecular arrangement, has not been in use long enough to warrant conclusive statements either advantageous or disadvantageous. This anesthetic is slightly acid in reaction but produces a very profound and lasting anesthesia in 0.75 per cent solution. Its toxicity in animal experimentation is equal to that of procaine.

A strong impression has been created in the minds of many clinicians that epinephrine greatly increases the toxic effects of local anesthetic solutions and that cobefrin is less toxic.

Some vasoconstrictor is necessary in the use of the procaine anesthetic solution to retard absorption, thereby prolonging the anesthesia, and at the same time preventing toxicity of the local anesthetic due to too rapid absorption. Epinephrine in the proper dilution is not unduly toxic in a normal patient, and very few severe reactions will result if the injection of the procaine epinephrine solution is made slowly.[5]

Miller's[6] experiments showed that all epinephrine procaine solutions had some effect upon the heart rate, proportionate to the concentration of the epinephrine. It is interesting, however, to note that a concentration of epinephrine 1:50,000 increased the heart rate an average of ten beats per minute, compared to nine beats per minute with 1:75,000 concentration; while cobefrin 1:10,000 concentration increased the heartbeats eight per minute. Greater concentration of epinephrine, that is, 1:25,000, accelerated the heart twenty-seven beats per minute, and 1:20,000 concentration affected the respiratory rate as well.

Tainter and Throndson,[7] on the other hand, found that cobefrin 1:10,000 produced greater change in pulse rate and blood pressure than epinephrine 1:50,000. They reported also, that epinephrine 1:50,000 when injected in fatal animal dosage decreased the toxicity of procaine to the extent that 50 to 100 per cent more of the procaine solution was necessary to cause death while cobefrin procaine anesthetic solution caused death with just slightly more dosage than when procaine was used alone. The explanation is to be found in the maintenance of blood pressure by epinephrine over a long enough period to permit detoxification of the larger amounts of procaine.

The natural extract of epinephrine has about twice the vasoconstricting power of the synthetic product unless the synthetic epinephrine is levorotatory.[8] Furthermore, as to its stability, the natural product may be boiled three times before decomposition takes place, to once of the synthetic product.

DOSAGE OF VASOCONSTRICTOR

It is not necessary, in the majority of cases, to use a vasoconstrictor (epinephrine) in greater concentration than 1:50,000 for satisfactory results in oral surgery and exodontia. In myocardial disease or coronary sclerosis epinephrine solutions should be used very cautiously and in a concentration not greater than 1:50,000. Certain cardiac or thyrotoxic cases may indicate the elimination of epinephrine altogether, although in our experience 1:50,000 epinephrine procaine solution has produced no untoward effects in these cases where caution and slow injection were exercised.

ADVANTAGES OF ALKALINE SOLUTION

Alkaline procaine solutions have the following advantages:

1. Quicker anesthesia due to early disassociation of the base from the salt.
2. Deeper anesthesia due to liberation of more of the free base.
3. Less cellular destruction of tissue.
4. Less postoperative pain or discomfort.

The preparation of the alkaline solution is considered by some to be a disadvantage. The demonstration to be shown will clarify this conception. Particularly with the ampoules of procaine hydrochloride (1:50,000 epinephrine) the method is positive and effective, requiring only the addition of four drops of sodium carbonate anhydrous to 3 c.c. of procaine hydrochloride. The borate tablets offer an alternate method in cardiac and thyrotoxic cases, if one prefers, which is likewise simple and safe, or in cases where more solution is indicated.

The syringes which have a plunger that can be drawn backward present an outstanding advantage to ascertain whether or not a blood vessel has been pierced. Much of the toxic effect of the injected solutions is traceable to injection into a vein. Hematoma likewise may be prevented frequently by this method.

The shorter duration of the anesthesia when using alkaline solutions has been advanced as a disadvantage. As a matter of practical clinical fact, the duration is as long as anyone could desire. By the use of the hydrochloride ampoule alkalized, the duration is anywhere from one to two hours in most cases, which is ample. The borate does produce a shorter anesthesia, because of less procaine base, but it can be used where a shorter duration such as thirty to forty-five minutes only is required or desirable. There are innumerable occasions where such a duration is all that is necessary; furthermore it is desirable that the tissues return to function as soon as possible.

Stability of solution is not a factor by the ampoule or tablet method, as the solution is prepared and used immediately, and as desired. To be sure, care must be exercised against contamination, and sterile technique is a good thing from any point of view.

SUMMARY

With the advent of the newer research in alkaline local anesthetic solutions, procaine has become even more strongly entrenched as the safest and most effective of local anesthetic agents. In combination with epinephrine, good judgment counsels caution when it is used in cardiac disease or thyrotoxic patients, but it still remains the method of choice over general anesthesia. In those patients in whom psychic trauma is a factor or in epilepsy, preoperative sedation with a barbiturate makes its use possible. The one outstanding contraindication to procaine epinephrine local anesthesia is an acutely infected field; but, if block anesthesia can be employed, acute inflammatory processes usually present no difficulty, and a satisfactory anesthesia can be induced.

The advantages of procaine local anesthesia are:

1. It can be used in individuals with organic or systemic diseases where a general anesthetic is inadvisable or contraindicated; in the elderly or in those of low vitality.

2. It is particularly adapted for ambulatory cases and where the patient's cooperation is desired.

3. It is noncumulative and non-habit forming and with epinephrine controls hemorrhage.

4. The duration of the anesthesia can be controlled; the operator is not required to hurry and the field of operation is not obstructed.

5. There is much less danger in its use than with a general anesthetic, and the danger of aspirating foreign bodies is eliminated.

6. Anesthesia may be secured removed from the field of operation and large or small areas anesthetized as the operator desires.

7. Anesthesia is not affected by drugs such as alcohol, excessive tobacco, or narcotics.

8. Used properly, it has practically no postoperative effects, and traumatic surgical shock is eliminated.

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FALLACIES IN CLINICAL OBSERVATIONS

JEROME S. GROSBY, D.D.S., ST. LOUIS, MO.

THE role played by the clinician in research is all-important. To him is delegated the burden of proving or disproving the value of diagnostic and therapeutic aids. Often contributions of real value are born in the office of the practicing dentist. To the same extent his findings, if based upon fallacious reasoning, may result in as much harm as good. It cannot be denied that dentistry is an art as well as a science and as such is forced into occasional empirical methods. Yet it should never be forgotten that the profession rests on the foundation of scientific fact and that the rational viewpoint of science should always be uppermost in mind.

Often we are led by our fervor and enthusiasm into many pitfalls. Unfortunately the old *post hoc ergo proctor hoc* is too frequently substituted for controlled scientific procedure. To cite an example: Mr. G. had a sore throat. Since it did not respond to usual home medication he went to Dr. A. for treatment. After several visits, seeing no apparent improvement, he became dissatisfied and upon recommendation of a friend went to Dr. B., who treated him in much the same manner as did Dr. A. Mr. G. improved rapidly and Dr. B. was given full credit; this was natural reasoning for the layman. Two possible glaring errors of judgment, however, stand out. Either his sore throat might have become better of its own accord or Dr. A's. treatments may have been beneficial but the results not manifest until after he had seen Dr. B.

Reasoning from false premises or partial facts is often faulty and frequently, as in the above case, unjust. Yet this very type of thing is not unusual among professional men. Let us examine a few instances and see how pernicious it becomes. A dentist once wrote a paper claiming that all cases of pyorrhea were accompanied by some degree of constipation. He corrected dietary faults in all cases, ameliorating the constipation, and his results were quite satisfactory. Splendid, but in every case report that he presented he stated that routine and thorough prophylaxis was done, occlusal defects were remedied, and local medication used. It is true, from a clinical standpoint, that results count, but his work is valueless as a scientific contribution because we have no way of knowing whether it was treatment of constipation, prophylaxis, local medication or correction of abnormal occlusal stresses that produced the improvement. There was no control for the experiment.

Here is another example. Dr. X. is a firm believer in the use of intravenous neoarsphenamine therapy in Vincent's infection. He uses it in most cases and claims a good percentage of favorable results. At the same time he uses local treatment as an adjunct and thoroughly instructs the patient in home care. In spite of all this, it is the intravenous use of neoarsphenamine that receives the credit for favorable results. The fact that Vincent's infection often occurs

in syphilitic persons under active neoarsphenamine therapy is disregarded along with the possible benefits of the local therapy used.

Personality, most important to the professional man, has no place in scientific judgment of therapeutic values. Dr. W. has been using a certain topical anesthetic with excellent results. Dr. W. likewise has an engaging personality and inspires confidence in his patients. He is discounting this confidence and the possible power of suggestion and is giving sole credit to the anesthetic agent.

One may say, "Well, what of it, as long as desired results are achieved?" Dentistry is a profession dealing with pain and disease in mankind. As such it is humanistic. It is also a science and consequently cold, hard, and factual. When Dr. W. tells of his success with the topical anesthetic and when Dr. X. praises intravenous neoarsphenamine therapy and when another dentist tells of treating pyorrhea by correcting the ever-present (?) constipation, other men, always seeking means to help their patients, take up these methods. They may even raise the hopes of their patients to great heights. When the treatment falls short of promise, the patient is disillusioned, the dentist crestfallen, and instead of a valuable contribution being made, great harm is done and confidence is lost. (Remember Hartmann's solution?) This could all be avoided if we would only hesitate and apply sound scientific reasoning and impartial observation.

One more word of caution. Favorable results in the use of a certain technique or remedial agent in two, five, ten or twenty cases mean very little. The element of individual variation can be reduced (never eliminated) only by a study of large numbers. The greater the number of cases the less the possible percentage of error due to variations from one individual to another.

By maintaining a critical (not criticizing) attitude and preserving the scientific method of examination and evaluation we shall go farther and achieve more lasting results. Bearing this in mind, the clinician can continue to contribute much of value to his profession. In the words of the Chinese sage, "Walk softly, go far."

634 N. Grand Avenue

CONSIDERATION OF THE PATIENT FOR DENTAL ANALGESIA AND ANESTHESIA

F. R. Arcara, D.D.S., F.I.C.A., Norristown, Pa.

PAIN is wholly an anesthetic problem, and the sooner dentists become well versed in anesthesia the sooner pain will be eliminated in dentistry. I have practiced anesthesia with nitrous oxide and oxygen for seven years, and since July, 1936, I have successfully practiced analgesia in my preparation of cavities, bridge abutments and porcelain jacket crowns. I find that the work can be done in less time, and that both the patient and the operator are relaxed and at ease. The feeling of numbness leaves the patient as soon as the toilet of the cavity is completed and filling is placed, and the patient is left in a better frame of mind to make and keep his next appointment because of the fact that analgesia with nitrous oxide and oxygen is a pleasant sensation.

CONDITION OF THE PATIENT

Lack of knowledge of the patient's condition causes dentists to forego the use of nitrous oxide and oxygen, analgesia and anesthesia. Once the dentist has a true picture of the patient's condition he will find that fear and nervousness will be eliminated from his mind, and he can safely also use preanesthetic drugs.

Before administering analgesia or anesthesia each patient must be properly prepared, the routine practice being as follows:

1. Take pulse rate of patient; a pulse of 60 to 90 is very good. I find that patients having a pulse of 72 to 80 are the least troublesome, because they are calm and serene, and usually take analgesia and anesthesia very calmly.

2. Test for nasal airways by placing cotton near outer nares for free nasal air passage. Then examine throat for obstructions, such as enlarged tonsils, tumors, and inflammations. Next apply the breath holding test by asking the patient to take a deep breath and to hold it while you time it:

CONDITIONS	SECONDS
Normal breath holding	45
Leaky heart valves	40
Diabetes	16-35
Thyroid disturbances	10-35
Anemia	15
Acute cellulitis	15
Sepsis	12
Weak cardiac muscles	10-20

3. Take blood pressure. Low blood pressure indicates that the patient has no stamina, as a result of: (1) toxins, (2) diarrhea, (3) shock, (4) low vitality.

High blood pressure indicates: (1) arteriosclerosis, (2) angina pectoris, (3) acute and chronic nephritis, (4) endocarditis, (5) valvular disease, (6) arterial hemorrhage, (7) arterial thrombosis, (8) syphilis, (9) pathological changes.

Height in relation to weight; five feet equals 110 pounds; and add 5 pounds for every inch for normal patient weight.

4. Take Tallqvist hemoglobin count, and for extractions, clotting time.

5. Urinalysis. Twenty-four-hour specimen is usually desirable because total excretion of both solids and water can be learned in this way. A single specimen is sometimes not useful, as sugar or albumin may be present at one time of day and not at another. An adult normally passes 1,000 to 1,500 c.c. of urine every twenty-four hours. A newborn baby has no control over the passage of urine and passes from 150 to 200 c.c. daily, and a five-year-old child passes about 700 c.c.

Appearance.—Normal urine is transparent, though a slight cloud of mucus may appear on standing. Cloudiness is generally due to pus, blood, bacteria, urates, or phosphates.

The consistency of normal urine is watery. Pathologically it may be frothy from the presence of sugar, or ropy from mucus or pus in alkaline urine.

Odor.—Normal urine has a faint aromatic odor. On standing a long time all urines are decomposed and have a very unpleasant odor. A specimen containing pus often develops a putrid odor on standing, as a result of bacteria.

Color.—Normal urine is amber or straw colored. With the injection of certain drugs and in some diseases the color may be blue or green. Methylene blue accounts for it. On rare occasions bluish urine appears from putrefactive changes in the intestines in cholera. Dark yellow or greenish brown is due to bile. A vivid yellow often appears in urine of persons habituated to phenolphthalein. This is indicated by its turning red when rendered alkaline. Melanin from a melanotic sarcoma may color the urine black. In salol, phenol, or iodoform poisoning the urine may turn black on standing. Silver compounds, such as argyrol, protargyrol, and so forth, used for irrigating, frequently color the urine a deep brown, especially the sediment formed on standing. Red, brown, or smoky color may be due to blood. Red in an alkaline urine may be due to phenolphthalein, rhubarb, senna, or cascara. Milky appearance is found when there is an admixture of chyle.

Reaction.—Normal urine is acid in reaction; may be temporary, neutral, or alkaline. An amphoteric reaction, the urine turns red litmus, blue; and blue litmus, red. Red is not unusual and has no pathological significance. Alkaline urine may be due to decomposition in the bladder, as in cystitis, with retention of the urine, or to administration of alkaline drugs.

Meat diet increases acidity. Fruit and vegetable diets diminish acidity. Thus a change in reaction may be from a pronounced alkaline, in a normal person, during the course of the day.

Specific gravity significances—normal 1.012 to 1.020. High specific gravity indicates pathology: (1) diabetes mellitus, (2) acute nephritis, (3) acute fevers.

Low specific gravity indicates: (1) diabetes insipidus, (2) chronic interstitial nephritis, due to inability of the kidney to excrete concentrated urine.

Albumin.—Albuminuria indicates albumin escaping through the cortex of the kidney.

Sugar.—The presence of glucose in urine does not mean the existence of diabetes any more than does albumin always indicate nephritis. After a diet rich in carbohydrates, glucose may appear in urine temporarily, and such a condition is spoken of as physiological or alimentary glycosuria. When glucose is persistently present in appreciable quantities, diabetes mellitus is indicated. Five to eight ounces a day has been found in average diabetic cases.

Indican.—Indicates constipation, due to oxidation products of the intestinal putrefaction of albuminous substances.

Bile.—In urine bile is always indicative of a pathological condition. It appears whenever bile is present in the blood, that is, jaundice from any cause.

Diacetic acid, acetone, or *ketone bodies* found in acid urine are indications of simple or complicated acidosis. When they are present in diabetic urine, it is considered gravely significant. They represent the failure of the diabetic patients to oxidize the fats completely. These ketone bodies and products of incompletely consumed fats appear in excess in the blood and are transferred to the kidneys for excretion. Fasting, anesthesia, and so forth, produce a temporary acidosis with acetonuric signs.

Before administering analgesia or anesthesia, have the patient take a cathartic, preferably citrate of magnesia, because of its threefold action on the liver, kidneys, and intestines. This cathartic should be taken a few days before the administration of nitrous oxide and oxygen for the first appointment. On the day of administration, do not allow the patient to drink or eat for two or three hours before, to give food and water time for digestion, assimilation, and evacuation.

SUMMARY

Dentists must make a thorough examination of all patients: (1) take pulse rate, (2) test nasal airways and examine throat, (3) breath holding tests, (4) blood pressure, (5) take Tallqvist hemoglobin count, and for extractions, also clotting time, (6) urine analysis.

Patients must be prepared before administration of analgesia or anesthesia: (1) by drugs, (2) bowel evacuation, (3) must not eat or drink for two or three hours before administration.

211 De Kalb Street

GUM RESECTION

H. A. Drum, D.D.S., Inglewood, Calif.

THE patient was a Mexican boy, 14 years old. He gave a history of coming of a large family, living mostly on a starchy and heavy diet.

Diagnosis.—Condition of the gums was due to malocclusion and the faulty diet.

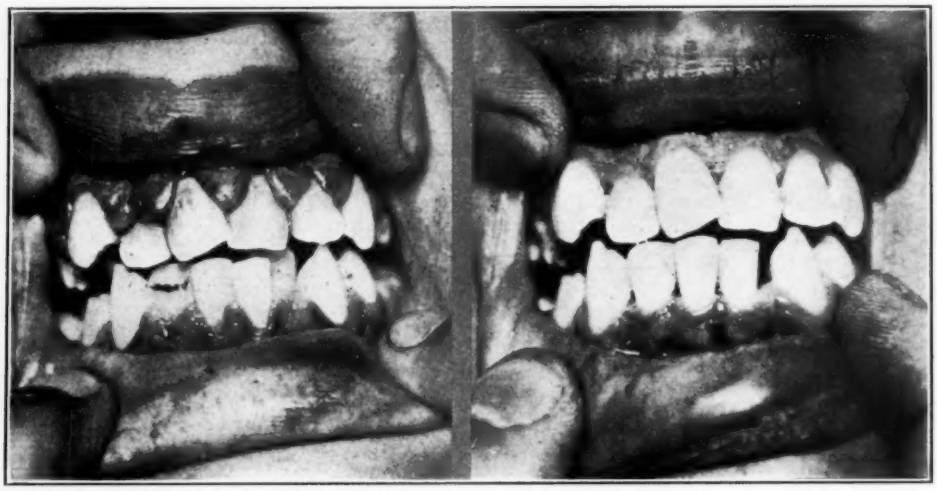

Fig. 1.—Before treatment was begun.

Fig. 2.—Three months after treatment.

Treatment.—Orthodontic treatment was recommended, but the family was not in financial circumstances for it.

The mandibular left lateral incisor and the maxillary right second bicuspid were extracted to relieve the crowded condition.

The gums were anesthetized with novocaine, and a pair of small curved surgical scissors was used to trim the gums back to normal. They were then packed with wonderpak for ten days.

Massage with a rubber brush was recommended.

The patient's diet was changed, to reduce the starches and to increase the amount of vegetables. Vitamin A was prescribed for three months.

205 Professional Bldg.

Case Reports

This month the editor himself presents a case which illustrates the importance of pathologic examination of excised tissue. A small amount of membrane attached to an extracted tooth may be just the remnant of the dental follicle, but it also may be new growth; adamantinoma may form in the young or carcinoma may form after middle age from remnants of tooth germs.

CASE REPORT NO. 15

CARCINOMA OF THE MANDIBLE

KURT H. THOMA, D.M.D., BOSTON, MASS.

THE patient, Mr. E. G., aged 70 years, a plasterer by trade, complained of a swollen face, which he had had for almost a year. Family and past history were irrelevant. Present illness started with a swelling that extended from behind the ear to the neck, and it was difficult for him to move the neck on account of pain. Eight months ago he was admitted to the hospital. X-ray pictures of the face were essentially negative except for an unerupted third molar in the mandible. The treatment consisted of two incisions, but there was no pus. Deep heat treatment was given, which relieved the symptoms to some extent.

The surgeon who took care of the patient thought that the mass in the neck was a deep abscess and probably not carcinoma. He operated on it and found a softening in the midst of the swelling, but no pus; the entire mass felt inflammatory and not like a tumor. A frozen section also showed no tumor. The patient was then treated with flaxseed poultices for two to three days. At this time there was a swelling at the anterior pillar and pressure applied on the tonsil caused a large amount of foul-smelling debris to discharge. The surgeon believed that the tonsil was the cause of the infection. Later the patient received eight x-ray treatments which improved the condition somewhat.

Lately, however, he had been getting worse; he could not bend his head forward or twist it without a great deal of acute pain. Examination showed swelling on the left side of the neck extending down the sternomastoid muscle. This swelling was hard and showed evidence of a scar where the incision had been made. Examination of the mouth showed pus discharge from the region of the left mandibular molar.

Roentgen examination (Fig. 1) showed a radiolucent area extending from the left mandibular second molar to the unerupted third molar; this area was interpreted as infection, chronic osteomyelitis of dental origin. Excision of the two teeth and drainage were recommended.

The operation, performed with gas and ether anesthesia at the hospital, consisted of extraction of the second molar and excision of the unerupted third

Fig. 1.—Roentgen picture of tooth showing osteolytic changes supposed to be due to pericoronal infection extending to the apices of the third molar. There is marked resorption of the roots of this tooth.

Fig. 2.—Low power photomicrograph of the third molar showing evidence of apical resorption and hypercementosis with soft tissue attached showing carcinoma: *C*, cementum; *Ca*, carcinoma; *D*, dentine; *P*, pulp; *H*, hypercementosis.

molar. When the latter was removed it had some soft tissue attached to it, and therefore was preserved for pathologic examination. A bacteriologic culture was taken and sent to the laboratory. The report showed the presence of short chain streptococci and staphylococci. A dressing was inserted in the wound. After four days the patient was dismissed to the care of his local doctor. His neck did not improve as expected, and having had relief from x-ray treatments before, he was given four treatments which caused some improvement.

At home again the local physician incised the neck and evacuated two ounces of pus. While under his care the patient had rectal hemorrhages. He was sent back to me. I explored the neck and took a biopsy, and also had a proctoscopic examination made which showed a large tumor in the rectum.

Fig. 3.—High power photomicrograph of apex of tooth showing lacunar resorption, repair with osteocementum, and carcinoma in the fibrous stroma of the peridental membrane.

Gastrointestinal x-ray examination made the following day showed "irregularity of the rectum which suggests the probability of some infiltrating growth. The stomach, which empties rather rapidly, shows also some irregularity in the midportion of the greater curvature, suggesting an organic lesion probably in the nature of a new growth."

The next day the report from the biopsy was at hand and showed that it was epidermoid carcinoma, probably metastatic.

Pathologic Examination.—The specimen consisted of a tooth (third molar) with some soft tissue attached to the apices, and a tab of tissue projecting from the side. Microscopic examination showed the dentine of the tooth of the normal tubular variety with considerable secondary dentine deposited along the

pulp canal. This was tubular but not so well calcified as the primary layer. There was a fairly wide zone of predentine and a prominent layer of odonto-

Fig. 4.—Accessory root canal showing lacunar resorption, repair with cementum, and carcinoma in the soft tissue contained in the canal.

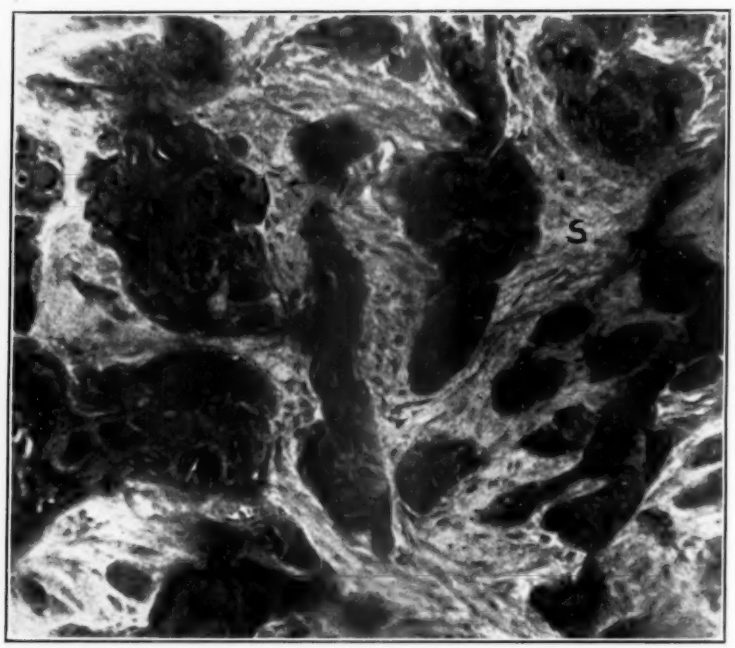

Fig. 5.—High power photomicrograph of carcinoma grade II in the peridental membrane: *S*, stroma.

blasts. The pulp in the pulp chamber appeared normal except for several pulp nodules (Fig. 2). The root canals showed a lateral apical branch in the mesial root. There was evidence of extensive resorption and repair of the

apical cementum (Fig. 3). The resorption had extended into the root canal; the lacunae which resulted from the resorptive phase were like those on the periphery repaired by apposition of cementum. This condition was seen in the main canal of the root as well as in the accessory canal shown in Fig. 4. There is some hypercementosis on the mesial aspect of the mesial root, and in the bifurcation. The soft tissue retained between the root at the apices and the tab extending to the mesial side was made up of dense connecting tissue similar to that of the peridental membrane, in which grew chains of keratinized epithelial cells of the type that may be classified as epidermoid carcinoma, grade II. These are shown in Fig. 5.

These cancer cells were found in close relation to the tooth, extending into the cemental lacunae almost like foreign body giant cells (Fig. 3), and were found to have penetrated into the accessory canal (Fig. 4). In the dense

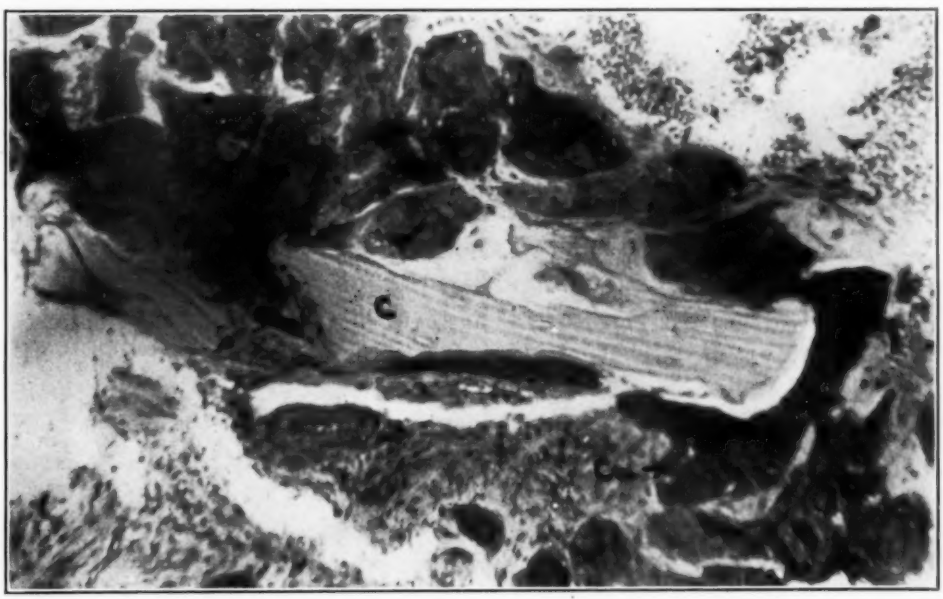

Fig. 6.—High power photomicrograph showing spicule of cementum surrounded by carcinoma.

fibrous stroma there was evidence of formation of cementum which was deposited around and between the epithelial strands. This must be considered as a calcification of hyalinized connective tissue, although in places it is lamellar in character and resembles true osteocementum. Other spicules of cementum have probably been detached from the tooth and migrated to fairly distant positions, such as that shown in Fig. 6.

Diagnosis.—Epidermoid carcinoma of the jaw.

The biopsy from the neck showed an entirely different type of carcinoma. It resembled the undifferentiated transitional cell carcinoma and showed numerous mitotic figures. It was therefore not only an entirely different type of carcinoma from that found in the jaw, but also much more malignant in character. If we consider that the malignancy of the stomach and rectum is probably due to adenocarcinoma we have a most interesting case of a patient with at least three different types of carcinoma involving four separate parts of the body.

Department of Orthodontic Abstracts and Reviews

Edited by

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Practical Pedodontia or Juvenile Operative Dentistry and Public Health Dentistry. An Introductory Text for Students and Practitioners of Dentistry. By Floyde Eddy Hogeboom, D.D.S., F.A.C.D., 1938, St. Louis, The C. V. Mosby Company.

This is the fourth edition of Professor Hogeboom's book on children's dentistry. The author's enthusiasm and pleasure in treating children are evident throughout the book. He states in his foreword, "I hope to popularize preventive dentistry for children to a greater extent than heretofore." The reader cannot help but become infected with Dr. Hogeboom's ardor in his special field of dentistry.

The opening chapter, on the management of the child in the dental office, should be carefully read by the general practitioner as well as by the specialist and the orthodontist. An axiom is laid down that to work on children it is necessary for the dentist to learn to manage himself as well as to manage the child. To be successful in dealing with children, four rules are given: (1) exclude the parent from the treatment room after the first visit; (2) make visits short; (3) do not deceive the child; and (4) never force the child.

Forrest N. Anderson contributes a chapter on "Mental Hygiene Viewpoints on the Child." To understand the reason for behavior, two principles must be accepted: (1) "behavior is purposive, not necessarily conscious. The organism strives towards a maximum of well-being or a minimum of pain or displeasure," and (2) "the motivation behind behavior is emotional." Anderson concludes his chapter with a list of valuable references for those who wish to read further along this line.

The chapters on "Development of the Child" and "Development of the Child's Head," while brief, cover sufficient ground to give the reader a well-balanced view of this important subject of growth and development.

The eruption of the deciduous teeth is discussed in detail. The importance of the retention of these teeth until their natural exfoliation, is stressed again and again to prevent malocclusion of the permanent teeth. This thesis, of course, is primarily the reason for the book.

The author, being an orthodontist as well as a dentist, brings to the reader's attention the necessity of correct approximal contact in the restoration of the deciduous teeth. What greatly interested the reviewer was the use of a silver palladium alloy in making inlays for compound cavities. The various filling

materials, with the exception of gold foil, are carefully analyzed, and suggestions for their manipulation and insertion are given. New formulas for pulp capping and root canal fillings should interest the general practitioner.

Thaddeus P. Hyatt gives several tables and graphs of the findings of examinations of more than twelve thousand persons. He stresses the importance of filling pits and fissures, regardless of the fact that no decay may be observed at the surface.

Harold F. Hawkins considers the effect of nutrition on the prevention of dental caries. Two interesting facts are worth repeating: (1) A high blood serum calcium and a low phosphorus balance are found in dental caries. This does not mean that the intake of calcium is high; it only means that it is higher than that of phosphorus. (2) In pyorrhea alveolaris there are a low blood serum calcium and a high phosphorus balance. The calcium being assimilated is less than the phosphorus.

Dr. Hogeboom believes that a space retainer should be employed when a deciduous tooth is lost a year or more before its average exfoliation. Two essential types of retainers are advocated. In the first a wire is soldered to two bands. The wire can be pinched with wire stretchers to accommodate growth. The second uses a wire and a buccal tube. This allows free movement and yet prevents collapse. Various appliances for prosthesis, orthodontics, and jaw fractures are shown and explained.

The question of restoring fractured maxillary and mandibular permanent incisors in children is a tragedy that the dentist occasionally faces. Fractures are divided into three classes according to the degree of the break. Adequate methods of restoring are shown to meet each situation.

Harry E. Straub considers the use of anesthetics for children and concludes that novocaine and nitrous oxide and oxygen, properly administered, are the best anesthetic agents for children. Dr. Straub gives in detail his technique for the surgical removal of the abnormal frenum labium. Unfortunately he did not accompany the text with drawings or illustrations, as he did with the previous one, to show the various methods of administering novocaine. Dr. Hogeboom concludes the chapter with the remark that many cases that are diagnosed as abnormal frenum labia are due to various degrees of hyperpituitarism, and that careful study should first be made before a final diagnosis is given.

Attention is called to the importance of prophylaxis. Various formulas of cleansers and methods of tooth brushing are given to help the dentist in keeping the teeth of his child patients clean.

In the chapter on endocrinology and its relation to dentistry the author asks the reader to familiarize himself with the various signs and symptoms of glandular disturbances. From the dental standpoint the four groups of glands of greatest interest are the thyroid, the pituitary, the parathyroid, and the gonads. Malocclusion not only must be considered from the local point of view, but apparently a relationship exists between certain forms of malocclusion and the endocrine glands.

In the final chapter, on public health and dentistry, the author goes into detail regarding dental clinics, health centers and dispensaries. He does not believe that voluntary service can be successful. On the contrary, there must

be "adequate financial underwriting by either taxation or philanthropy." Here, the reviewer must ask, "Can philanthropy meet this need adequately in order to preserve the general and dental health of the indigent children of this country?"

This volume contains an appendix and an index. The print is clear and large. There are more than three hundred illustrations, sharp and well reproduced. As Hogeboom states in his preface to this fourth edition, "I have tried to keep the book readable, informational and also practical." In this he has fully succeeded.

S. Trieff.

Editorial

Orthodontics*

THE profession of orthodontics has arrived at a period in its development which may be regarded perhaps as the most critical since the days of its inception. The profession has advanced to a point where it instinctively realizes its importance to the physical welfare of children. It knows from many years of experience that its knowledge and its efforts are necessary to the future normal dentofacial development of our youth.

Yet, just at the moment when we come to this splendid realization, we are confronted with elements of disorganization which may be considered twofold. One is the danger of unwise governmental interference through the strange and unaccountable aggressiveness of the politically ambitious. The other is due to the general letdown in fidelity and personal honesty. During recent years there is noticeable to thoughtful and observant men a tendency toward looser moral obligations in practically every walk of life. I am not certain where to place the initial blame, but it strikes me that it may be of a political nature. It has spread among the populace of the country so that men have lost their ambition to become *self-reliant*. They are being led away from the possibility of happy self-reliant living. In fact, there are millions of men in the United States today who seem to be less honorable than in former years. This applies to the professions as well as to other classes. Everywhere you will find men undertaking tasks for which they are not fitted, accepting rewards to which they are not entitled.

The preceding remarks have been made in order to give an opportunity to point out what, I believe, is the duty and the privilege of every orthodontist in the land. The original American Society of Orthodontists has recently taken a brave and important step forward. I refer to the reorganization which resulted in the adoption of a new constitution under the name of the American Association of Orthodontists. This word "association" is of great significance, and each one of us should try to bring himself to a correct understanding of its meaning. It implies a state of maturity. It indicates a state of mind which brings men together not only for the furtherance of advanced ideas, but for the purpose of mutual understanding, of harmonious association, of the suppression of sectionalism and the furtherance of mutual accord in every direction that may fit our profession for unselfish and efficient service.

Recently while being driven over a newly constructed highway, through a mountain range difficult to traverse, I noticed evidences of landslides; and gazing up the steep sides of these precipices I inquired what could be done to make the passage safe. My engineer companion replied with a phrase for which

*After an informal talk made by Dr. Alfred P. Rogers of Boston, before the Past-President's luncheon of the American Association of Orthodontists in Hollywood during the meeting in July, 1938, he was asked to write a guest editorial and enlarge upon the subject, for an early issue of the JOURNAL. Dr. Rogers' editorial is published herewith; the subject is timely and should be enthusiastically supported by orthodontists throughout the world.—EDITOR.

my mind had been searching ever since leaving our meeting at Los Angeles. He said, "These landslide areas will soon find their *angle of repose.*" Immediately the phrase struck me as being exactly suited to our needs, and my mind at once drifted away from the grandeur of those mountain passes to our association which recently had adjourned its splendid meeting with its fine spirit, led by a president who exemplified an attitude which should long be influential. My thoughts ran something in this manner—with this recent reorganization and with the evidence of a spirit of helpfulness, of mutual respect and confidence, perhaps we were approaching that angle of repose so essential to future development, and which is so necessary to a proper understanding of our important position in the world of therapeutics. To attain our angle of repose means that we have reached maturity where all the evidences of unreasoned disagreement have passed, where men from all sections of the country may meet together in profitable association without ever a selfishly ambitious thought, with a determination to strive not alone to make our association effective in promulgating the very best methods, the most scientific approach to aid us in our endeavors, but also to promote among its membership a determination to be of service before any other consideration. In fact this must be our fundamental determination if we are to continue to be strong, if we are to prepare ourselves to meet successfully the degenerative tendencies of the day. And this brings to my mind a matter of great importance, which is briefly stated as follows: Every man in our country who is worthy and has earned the right to become a member of this association should avail himself of this opportunity, not only as a duty but as a privilege, that he may have a hand in the protection of our ideals of service.

In the early days of development of any society of men mutually interested in a serviceable endeavor, there are apt to spring up misunderstandings often due to personality conflicts. This, as you know, happened during the early days of the American Society of Orthodontists, when we lost from our membership that great leader who had opened the door of opportunity to every man who practices modern orthodontics. I wish to give Dr. Edward H. Angle the credit which is due him for opening that door of opportunity not only to me personally, but, as I already have said, to every man who practices orthodontics. Therefore, I believe that the American Association of Orthodontists now gives an added opportunity for all to become associated, for all to work together in deep appreciation of the great opportunity which our first leader made possible. After his resignation from the American Society of Orthodontists, Dr. Angle continued his services to mankind by the development of a new and, for the most part, younger group of orthodontists. There were a few faithful ones whose conscientiousness impelled them to go with the leader and assist him in his new undertaking, and they are to be honored for their loyalty. But both groups had their strong men, and both groups have survived. It is clearly essential that organizations created to perpetuate the name of Edward H. Angle should continue their associations until the last; but should they not now join us in membership with the mutual purpose of carrying on, in this enlarged field, the works of our former leader? Among Dr. Angle's later group we recognize some of the most outstanding men in ability—men who have taken high places

in educational work, and men whose work is recognized as being of the very highest order. We should like these men to join us not only that we may be frequently in personal contact with them, but also for their scientific contributions, and most of all perhaps we want their influence and wisdom in the deliberations of our association so that we may stand shoulder to shoulder in a concerted effort to resist the possibility of any type of dictation that would lower our standards.

Our task in the near future will be to preserve our educational standards and the integrity of professional independence by which the children of this country alone can be served efficiently.

Changes, of course, there must be as social conditions change. We must be ready to meet these changed conditions with intelligence and seasoned judgment. We must be strong in our protection of childhood *from the inevitable result of lowered educational standards* and dictation from sources that cannot in any possible way attain a sympathetic or adequate understanding of our field of endeavor.

Alfred P. Rogers.

In Memoriam

Frank H. Harrison

1889-1938

Dr. Frank H. Harrison of Wichita Falls, Texas, was instantly killed and his wife and daughter, Rosemary, suffered minor injuries when their automobile overturned on the Brownwood-Brady Texas highway June 18. The accident occurred when a tire blew out.

Born at Big Spring, Texas, December 31, 1889, Frank Harrison was educated at Tyler, Texas, where he finished high school and business college. Subsequently he entered the employ of the St. Louis Southwestern Railway and held an auditing position, after which he was appointed chief clerk to the superintendent of the East Texas Railroad Company.

His dental education was begun at Southern Dental College, Atlanta, Georgia, in 1919, and after graduation the next five years were devoted to the general practice of dentistry. He completed postgraduate work in orthodontics at the Dewey School of Orthodontia in 1923, after which he was associated with Dr. P. G. Spencer, of Waco, Texas, from 1923 to 1928. Dr. Harrison moved from Waco to Wichita Falls in 1929 to take over the practice of Dr. N. H. Coleman, following the latter's death, and he practiced orthodontics exclusively there until his own death.

Dr. Harrison was an active member of the Texas State Dental Association and the American Association of Orthodontists, and a member of the American Board of Orthodontia. He had been president of the Wichita Falls District Dental Society, and was president of the Southwestern Society of Orthodontists.

Well known as a sportsman, he was also interested in boys' work and spent considerable time in helping develop and educate boys in scouting and better ways of living. The Southwest has lost a capable orthodontist, and a lovable character. Dentistry has lost, in his passing, another of its leaders and one of its sincere and devoted workers. He was respected by all who knew him, and orthodontists everywhere will miss his genial smile and friendly hand.

News and Notes

American Dental Association

The eightieth annual session of the American Dental Association will be held in St. Louis, Mo., October 24-28.

American Dental Assistants Association

The fourteenth annual session of the American Dental Assistants Association will be held at St. Louis, October 24-28, with headquarters at the DeSoto Hotel. For further informations, address

LUCILE S. HODGE, Secretary,
401 Medical Arts Bldg.,
Knoxville, Tenn.

American Dental Hygienists' Association

The American Dental Hygienists' Association will meet October 24-28 at St. Louis.

DAISY M. BELL, Secretary,
974 Amherst Street,
Buffalo, N. Y.

Association of American Women Dentists

There will be a meeting of the Association of American Women Dentists in St. Louis, October 24-28.

ELSIE GERLACH, President,
808 South Wood Street,
Chicago, Ill.
MABEL M. DIXON, Secretary,
City Building,
Hastings, Neb.

Forsyth Dental Infirmary for Children

There will be a reunion of all graduate internes of the Forsyth Dental Infirmary for Children, Boston, at the meeting of the American Dental Association in St. Louis in October.

To make your reservation for the luncheon in honor of the founders of Forsyth, as well as its director Dr. Percy Howe and his staff, write to:

DR. ROBERT A. HARRIS, JR.
University Club Bldg.
St. Louis, Mo.

North Atlantic Orthodontic Society

The ninth semi-annual meeting of the North Atlantic Orthodontic Society will be held on Wednesday afternoon and evening, November 16, at the Hotel Pennsylvania, New York City. All ethical members of the dental and medical professions are cordially invited.

EDWARD A. LUSTERMAN, President,
One Nevins Street
Brooklyn, N. Y.

Chicago Dental Society

The 1939 Midwinter Meeting of the Chicago Dental Society will be held February 13-16 inclusive at the Stevens Hotel. The meeting will once again return to its four-day length after an experiment with a five-day session last year. In 1938 the Midwinter Meeting achieved new records in attendance, with more than ten thousand visitors being registered during the five days. Greatly enlarged commercial and scientific exhibits were also features which will be continued for the 1939 meeting.

Great Lakes Association of Orthodontists

The twelfth annual meeting of the Great Lakes Association will be held in Cleveland, on November 7 and 8, at Hotel Statler.

RICHARD E. BARNES, Secy.-Treas.
1704 Republic Building
Cleveland, Ohio

Notes of Interest

Dr. Joel Margaretten announces the opening of his new offices in the Washington Professional Building, Los Angeles, Calif.

Dr. George S. Harris announces the opening of offices at 1802-1810 David Whitney Building, Detroit, Mich. Practice limited to orthodontics.

Dr. Samuel D. Harris announces the removal of his offices to 2312 Eaton Tower, Detroit, Mich. Practice devoted exclusively to dentistry for children and orthodontics.

Dr. Elmer O. Sunderman, successor to Dr. Harry C. Johnson, announces his office at 1014 Citizens Bank Bldg., Evansville, Ind. Practice limited to orthodontics.

Dr. G. Wayne Oglestone announces the opening of offices at 703 Second National Bank Building, Saginaw, Mich. Practice limited to orthodontics.